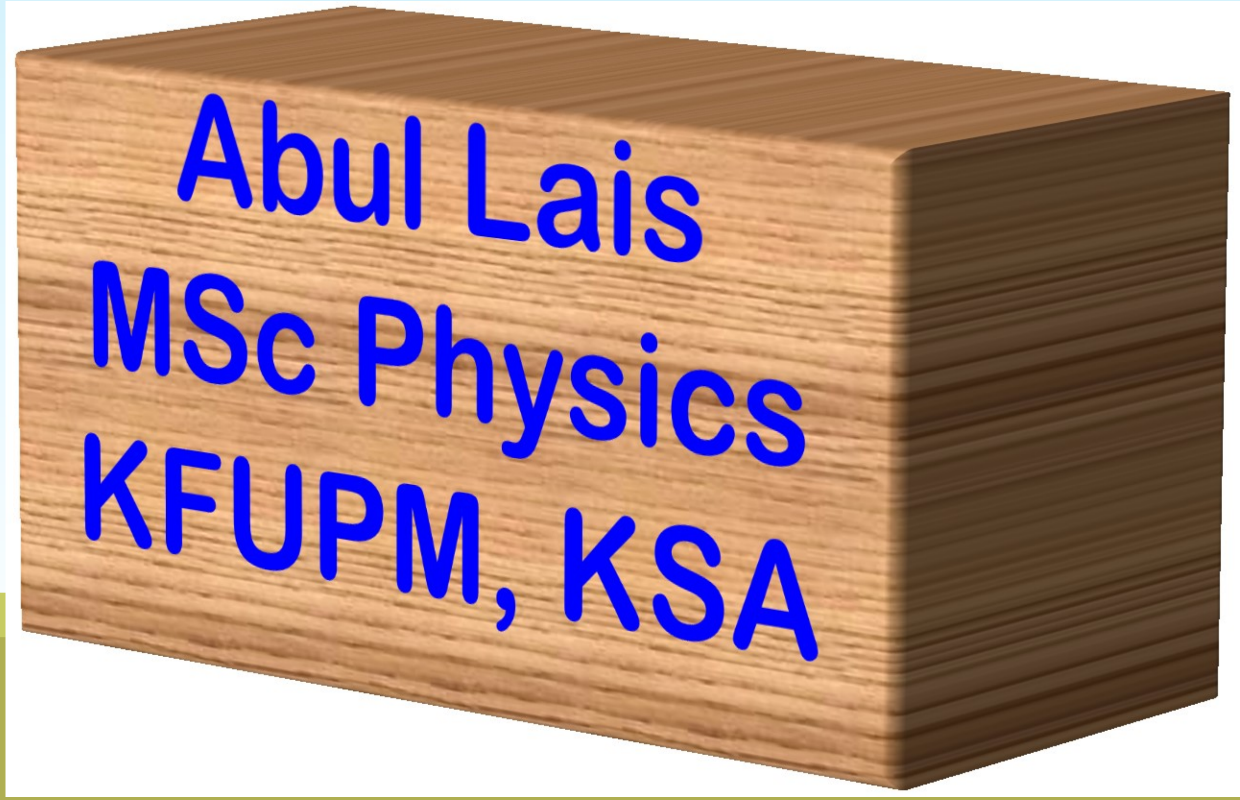
KFUPM PYP001 Old Exams

Revision for Major Exam 2, 172



Instructions

- These are the solutions for Physical Science KFUPM old exams
- It covers Chapter 14.1 – 18.3, all of major exam 2. For each question, first try the question yourself, then click next to see the answer, after that the solutions follow
- Try to read and understand the solutions even if you get the answers correct, as there is a lot of exciting chemistry concepts and theories explained clearly within the solutions.
- After this is the contents page, just click to go to the chapter you want
- Good luck!!!

Feedback

Any comments/feedback/suggestion for improvement, or if you need to discuss anything related to these questions, please do not hesitate to contact me at:

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14.1 Matter & Thermal Energy

14.1 Matter & Thermal Energy

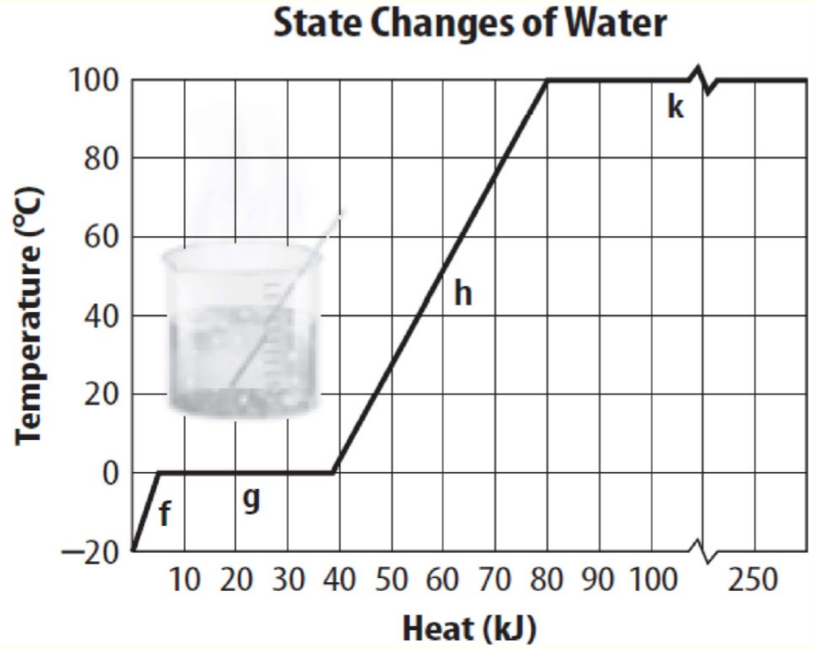
1. At which portion(s) on the graph below is the average kinetic energy of the water molecules increasing?

A) (f) and (h).

B) (g) and (k).

C) (g) only.

D) (k) only.



(162 Major 2, Q14)

14.1 Matter & Thermal Energy

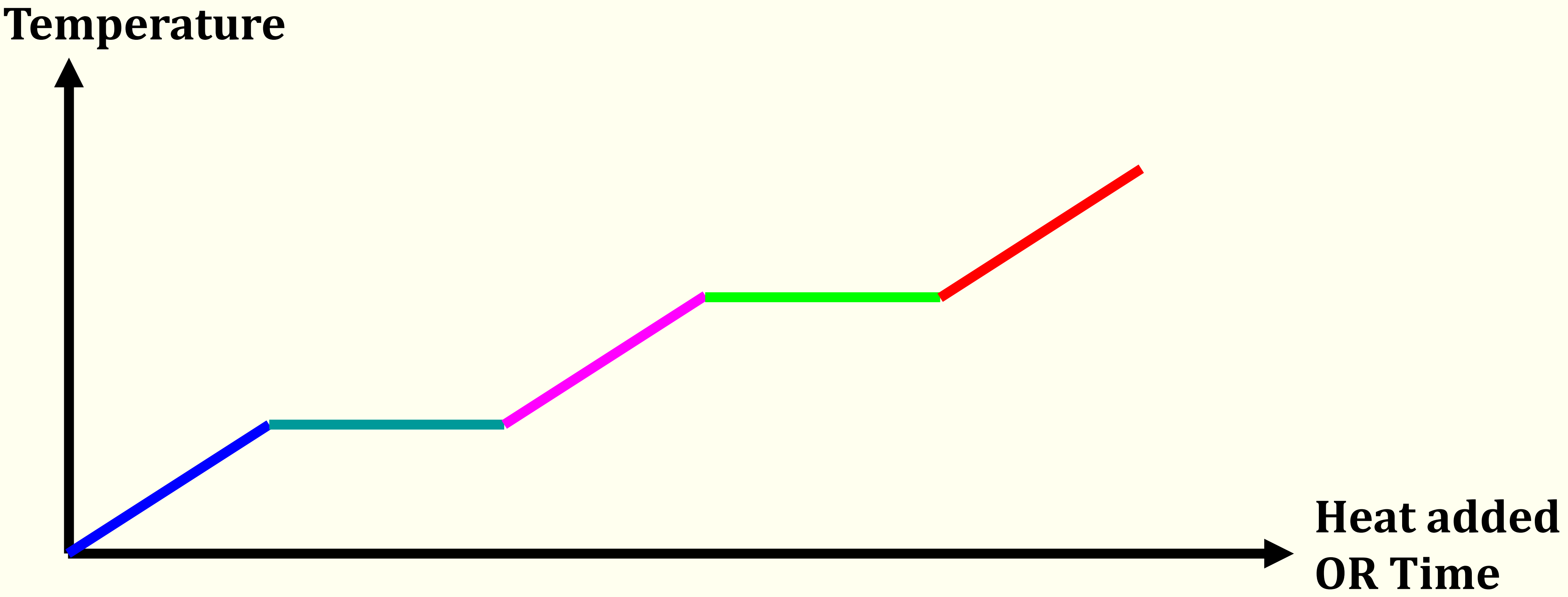
For heating curve questions, there are 3 things to consider:

1. What is the state of matter (solid/liquid/gas) on each line?
2. What is the energy (kinetic/potential) on each line?
3. What are the 2 axes labelled?

- Now we tackle each issues one by one… then return to the questions.

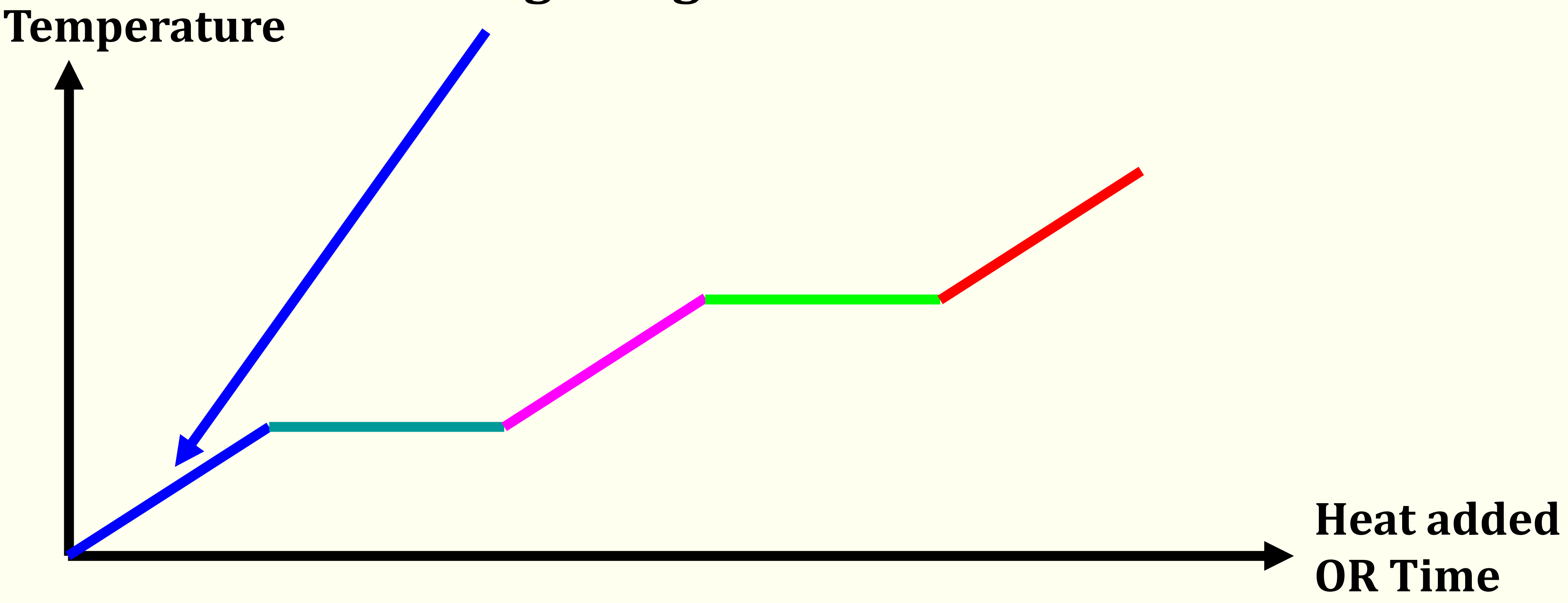
1. State of Matter

Basic ideas: a heating curve has <u>FIVE steps</u>



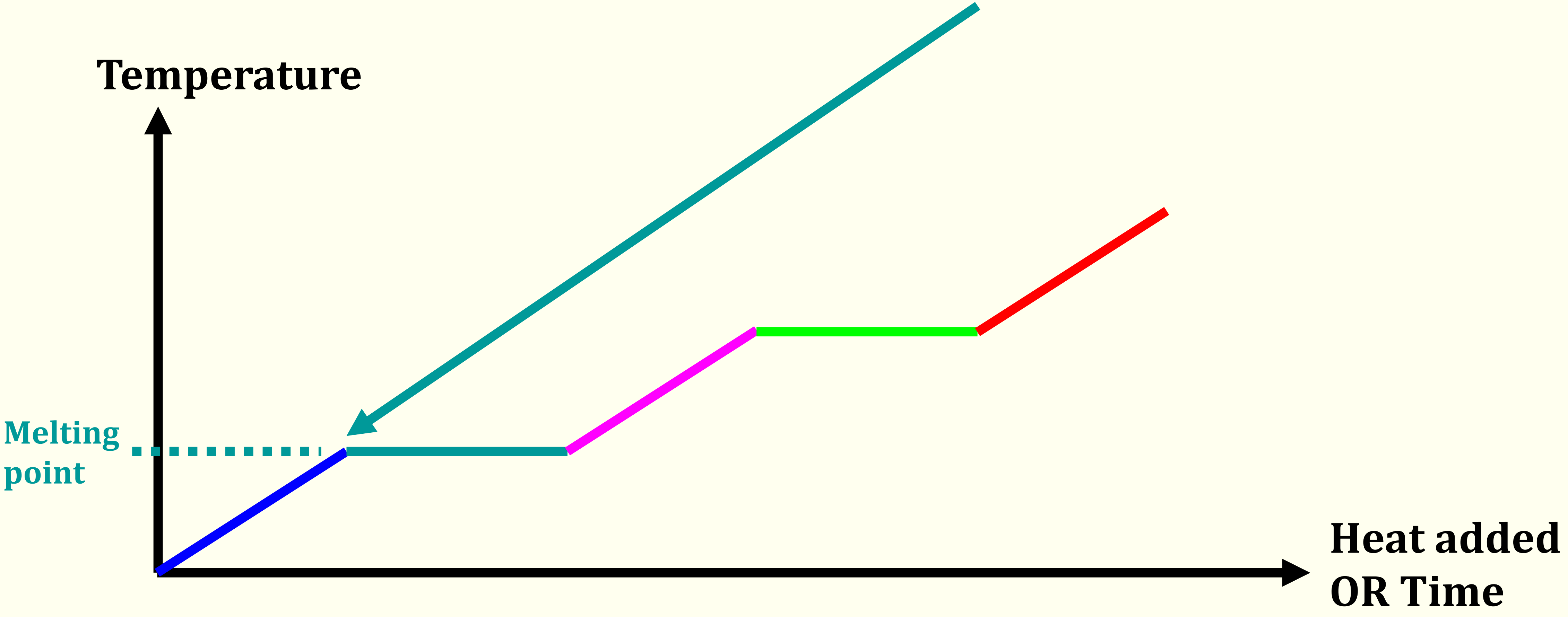
1. State of Matter

Start from coldest (lowest temperature) – solid – as temp. rises, solid is getting hotter until…



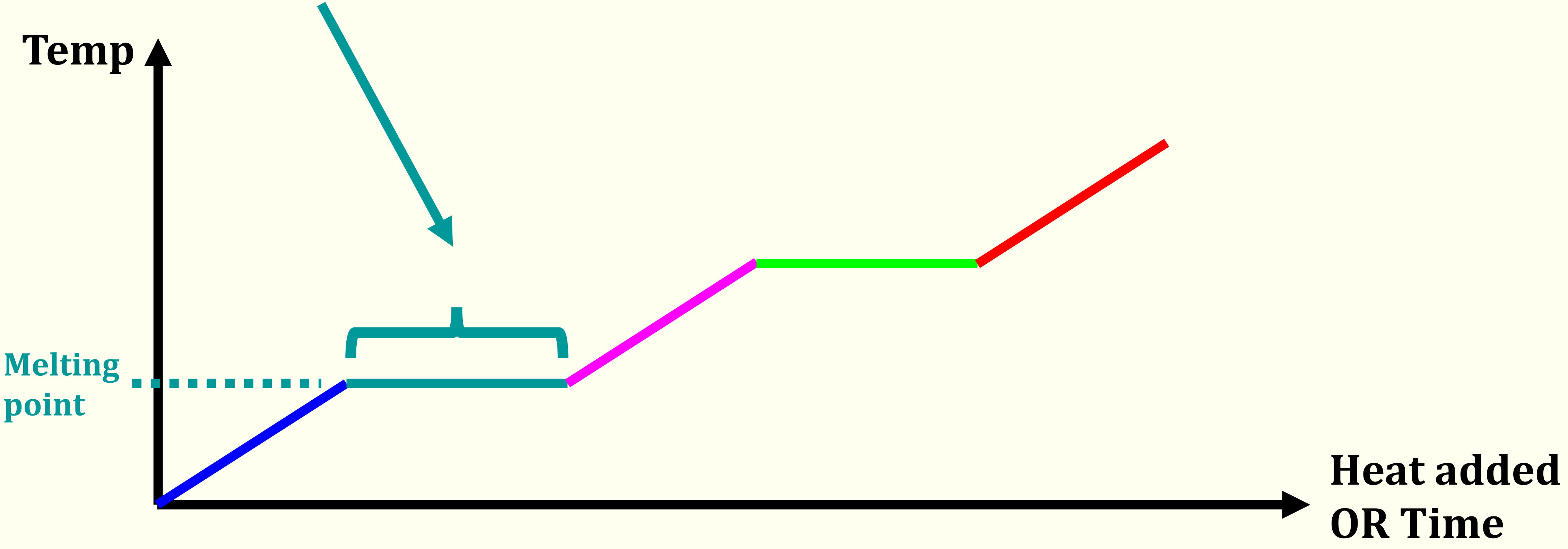
1. State of Matter

… until we reach **melting point** (some solid starts to become liquid)



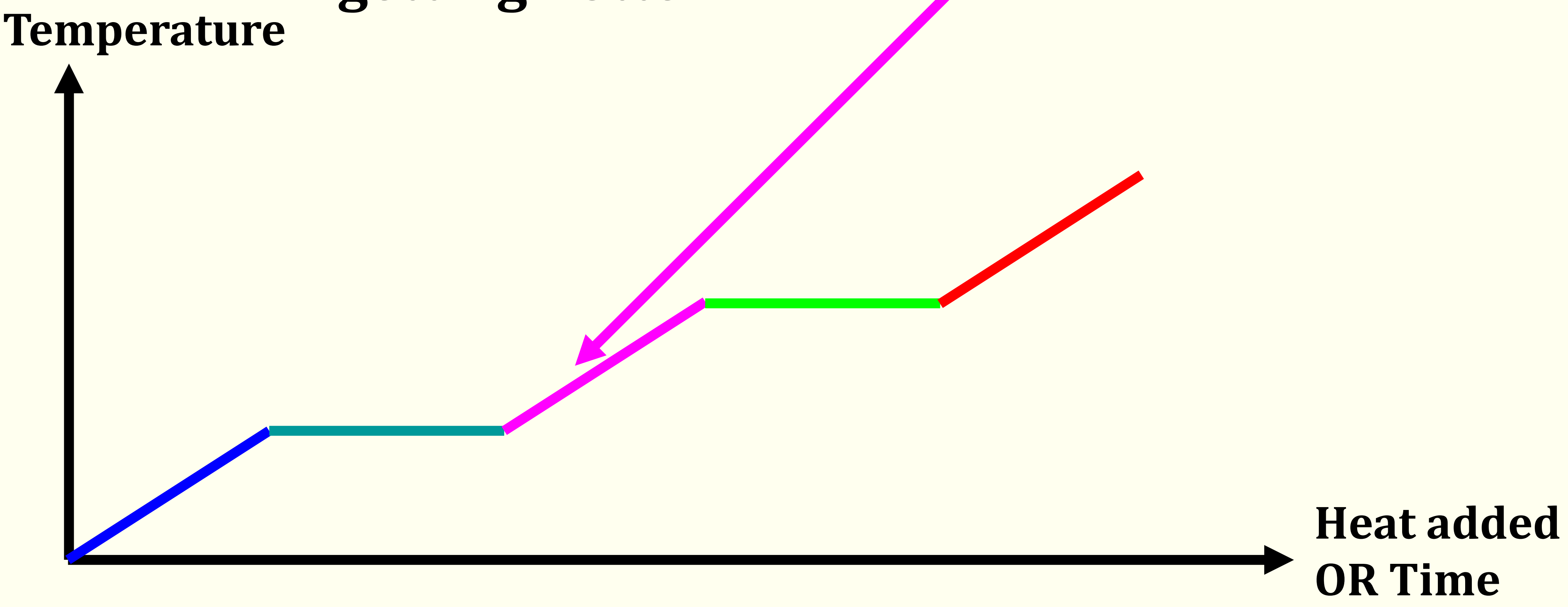
1. State of Matter

During melting <u>some solid becomes liquid, some still solid</u>, so mix of <u>solid + liquid</u>



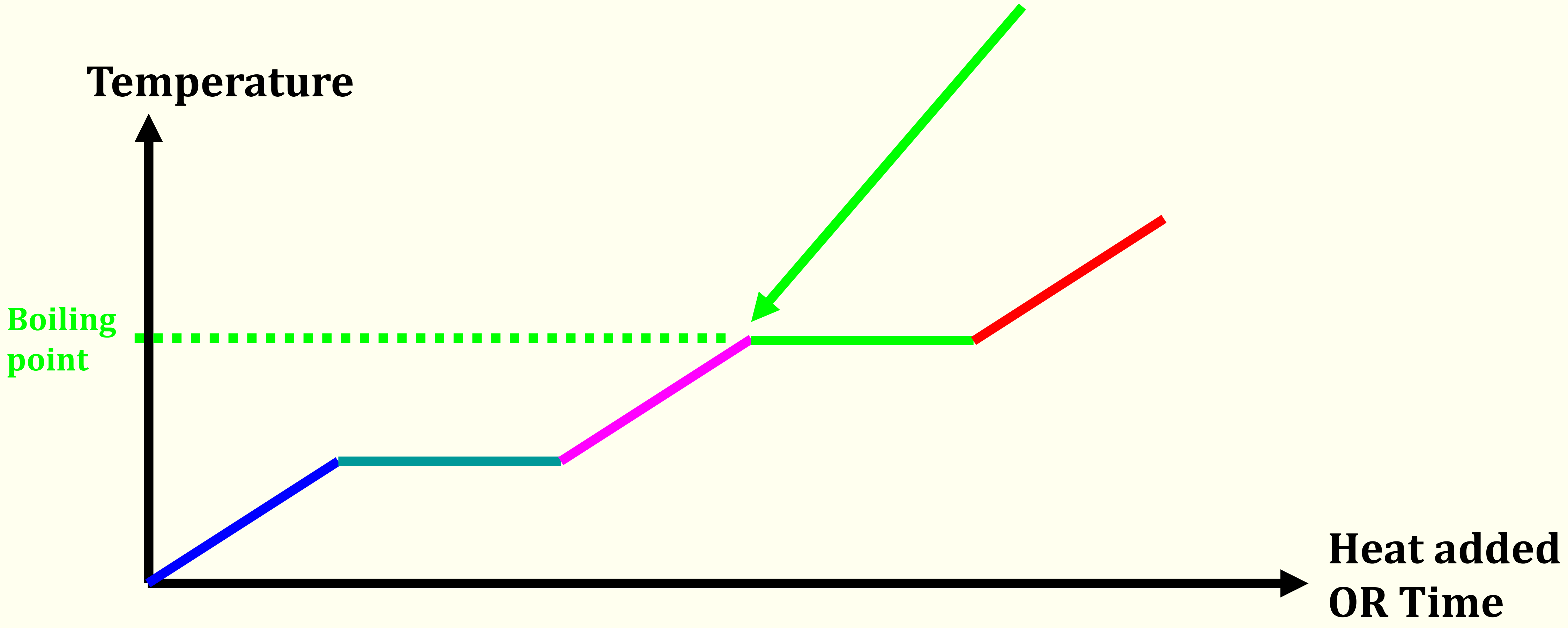
1. State of Matter

When all solid has melted, we have liquid bass!!! Liquid keeps getting hotter…



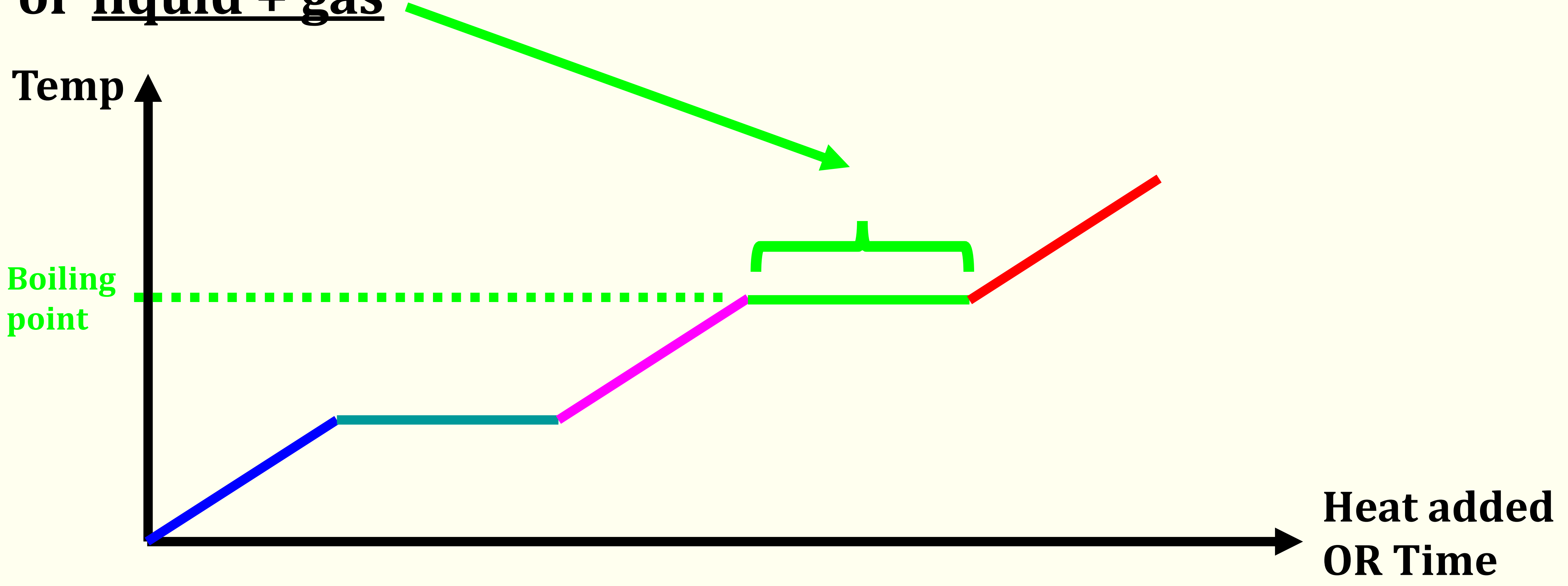
1. State of Matter

Liquid keeps getting hotter … until reach boiling point



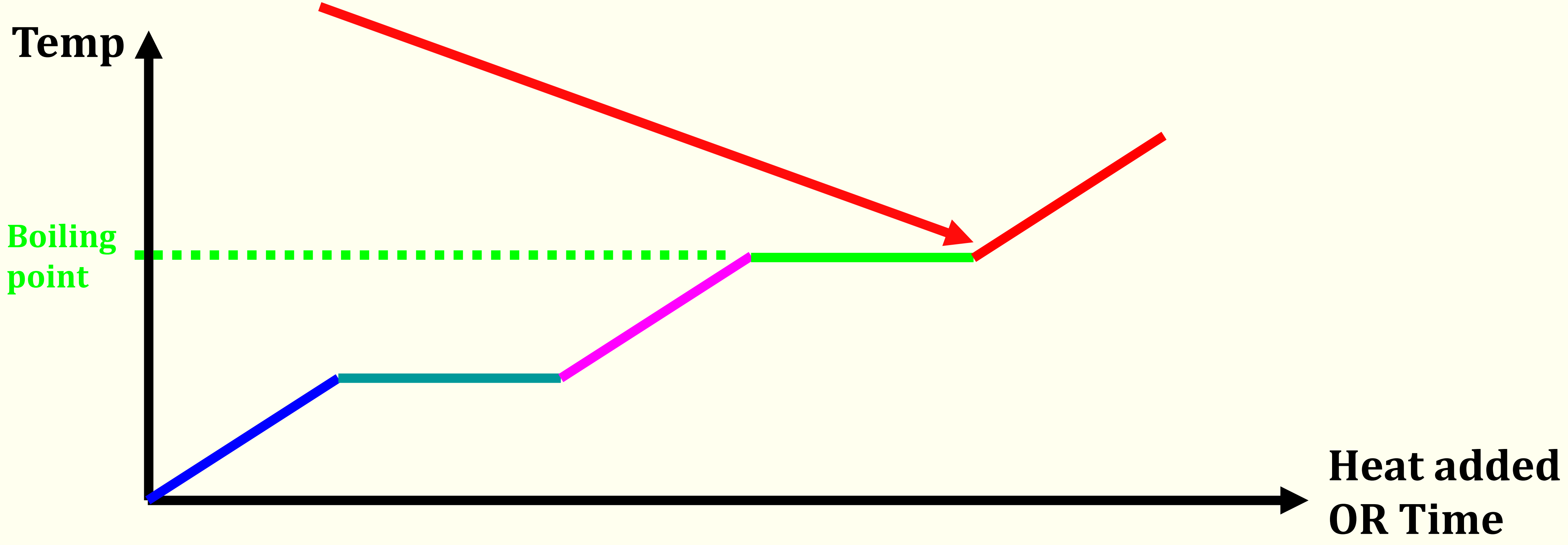
1. State of Matter

During boiling some liquid becomes gas, some still liquid, so mix of liquid + gas



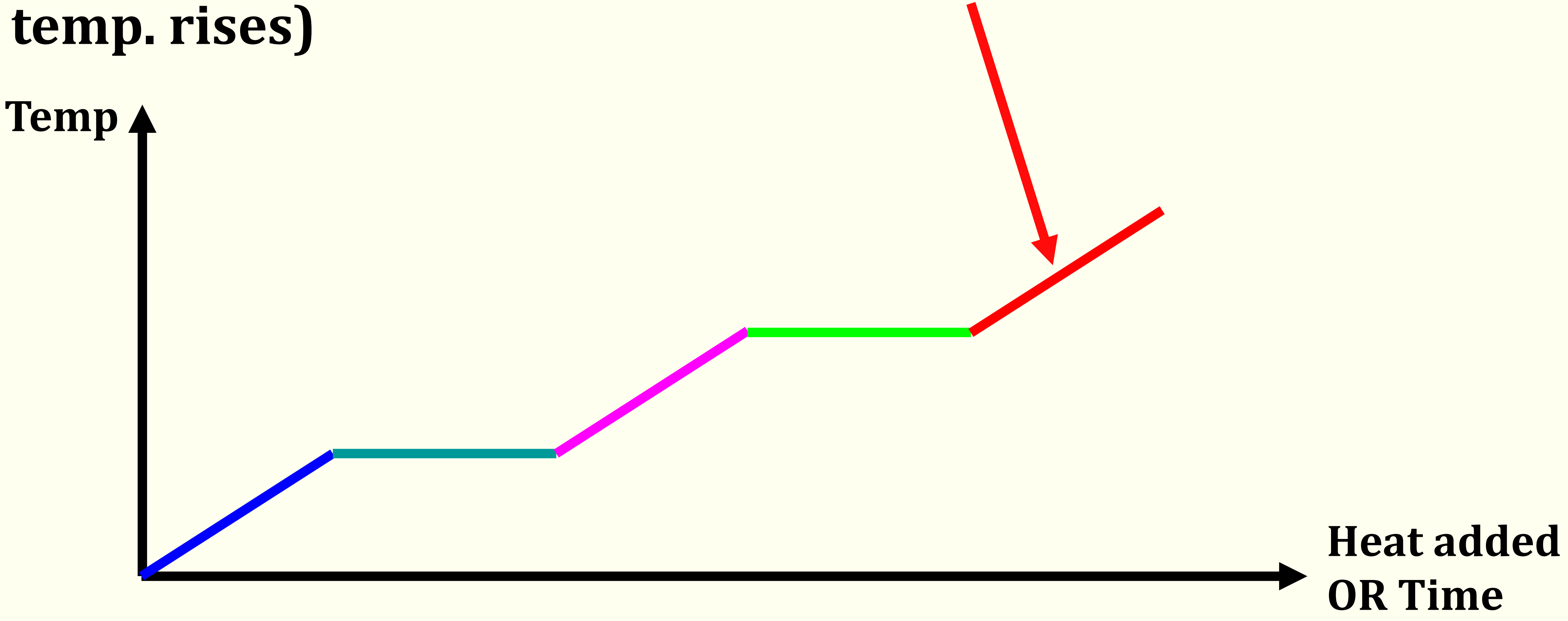
1. State of Matter

The boiling process continues until ALL liquid already become gas, so ONLY gas



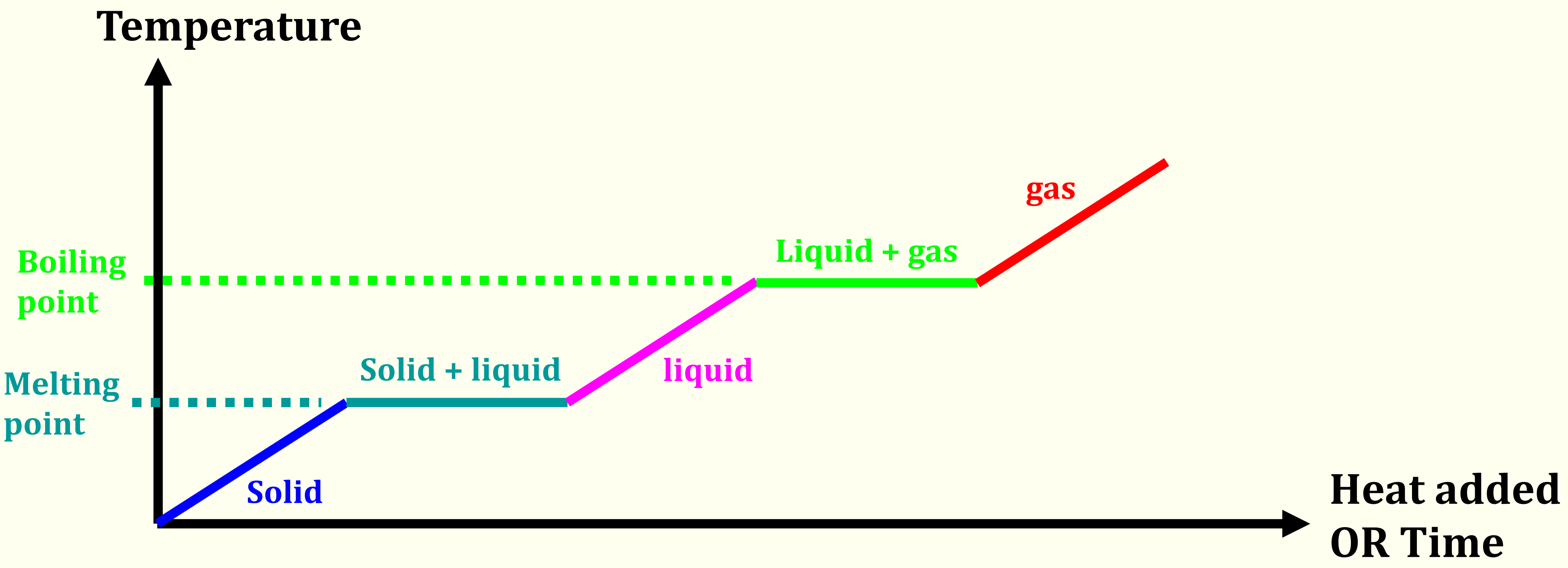
1. State of Matter

If we continue heating, the gas just keeps getting hotter (i.e. gas temp. rises)



1. State of Matter

Basic ideas: a heating curve has FIVE steps



2. Type of Energy

A molecule has 2 types of thermal energy (KE + PE)

Total thermal energy of a molecule = KE + PE

KE = movement of molecule flying about (Temp. $\propto$ KE)

PE = attractive force on molecule by other molecule

The 2 most important rules:

When temp. is changing, KE is changing

When state is changing, PE is changing

2. Type of Energy

Think: Why does temp. remain fixed during state change???

During state change (e.g. melting/boiling), attractive forces between the molecules (from one molecule to another) is being broken

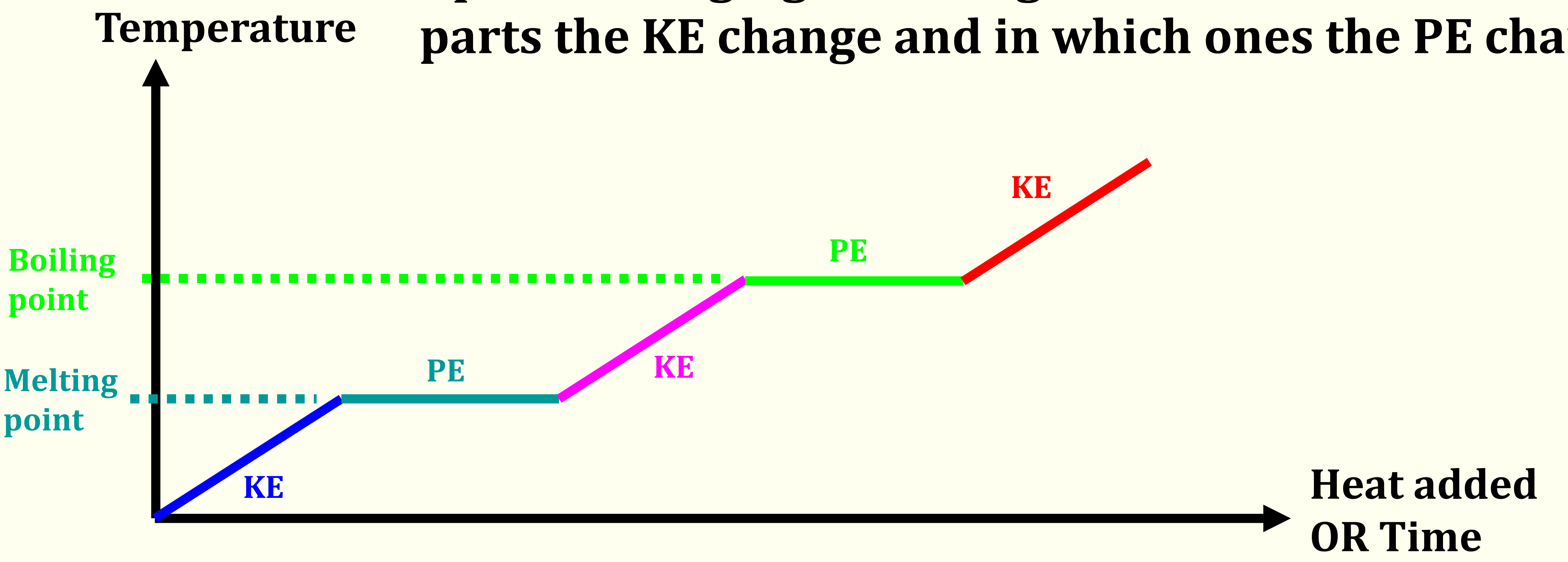
i.e. PE is increasing, so no energy left to increase the KE

So KE remain fixed → temp. doesn't change, during state change

2. Type of Energy

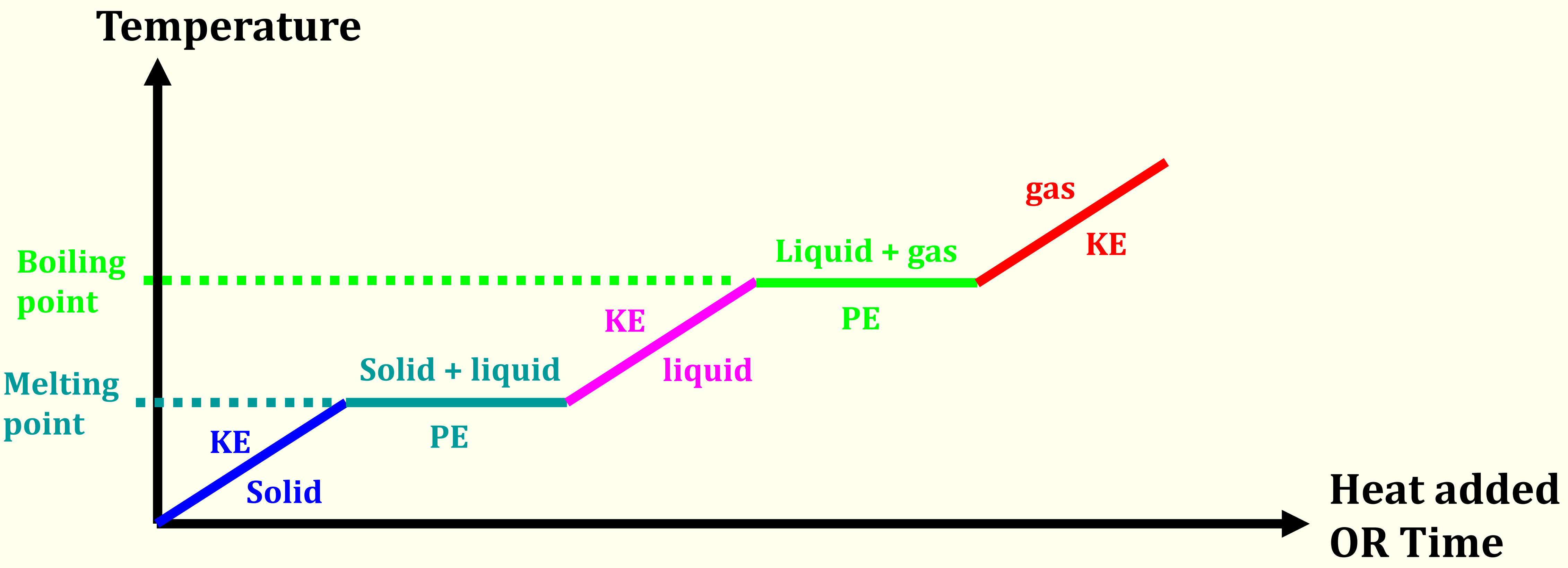
So we know: if temp. is changing, KE changes

if temp. not changing, PE changes. We now know in which parts the KE change and in which ones the PE change



1 & 2. State of Matter + Type of Energy

Combining both issues just discussed (state of matter & thermal energy), we get the following detailed graph…

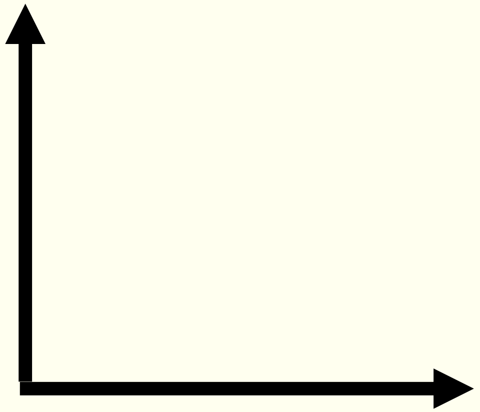


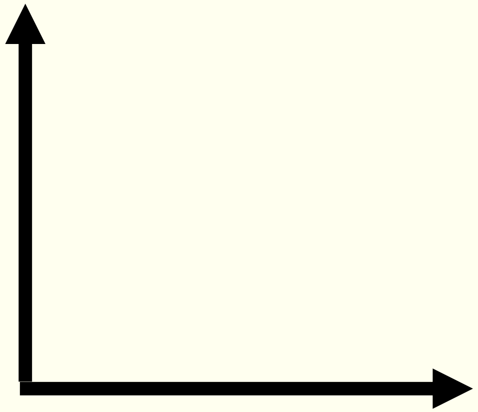
3. Type of Axis

As for the axis, there are 2 major issues:

1. The x and y axis can be FLIPPED (compare both below)

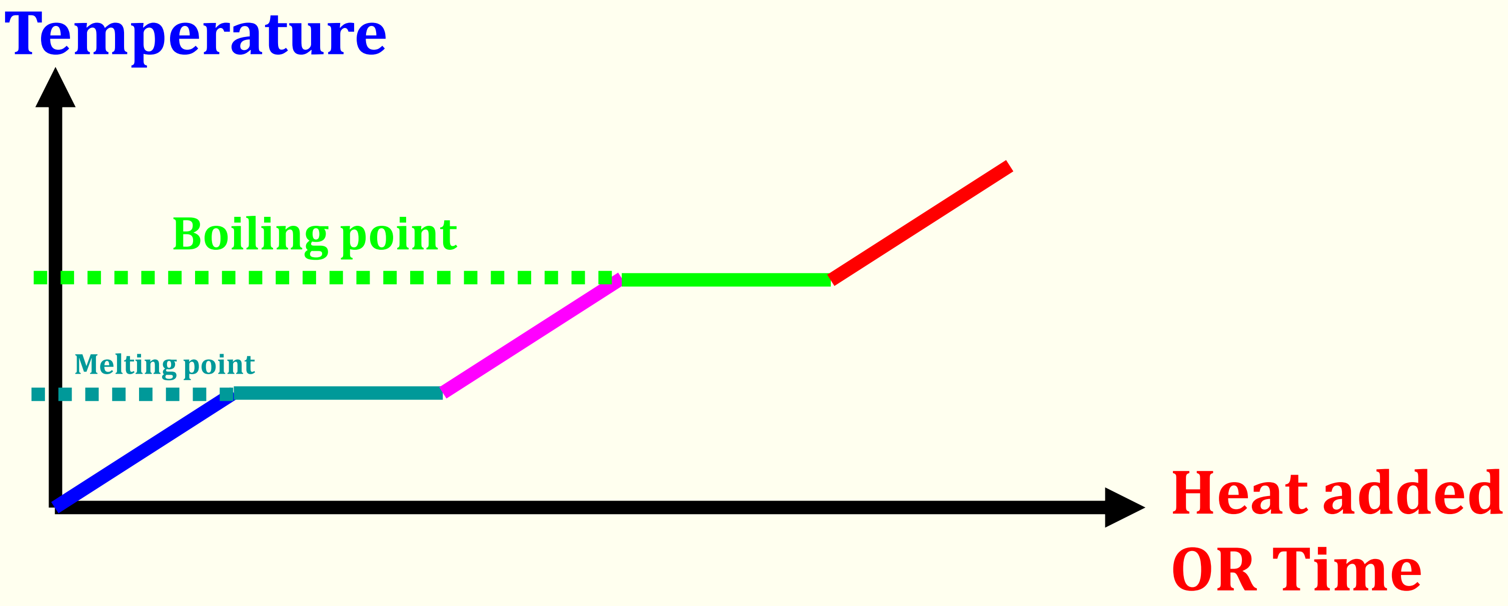
2. The time = heat added (look at any one graph from below)

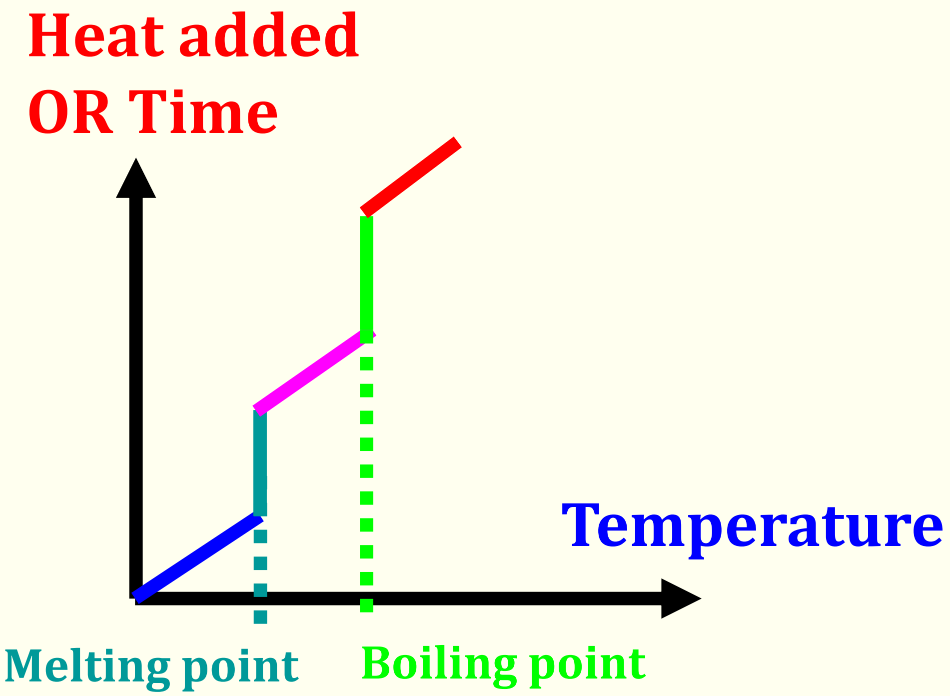




3. Type of Axis

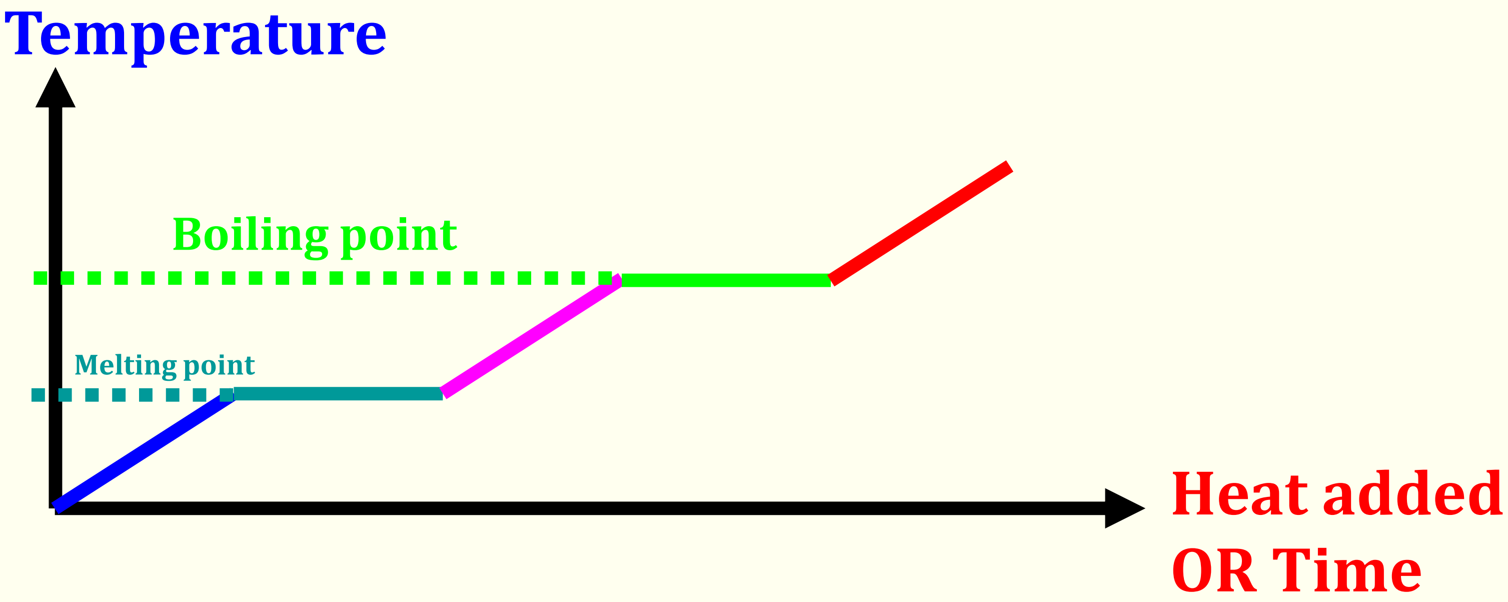
First issue: x and y axis can be FLIPPED (compare both below)

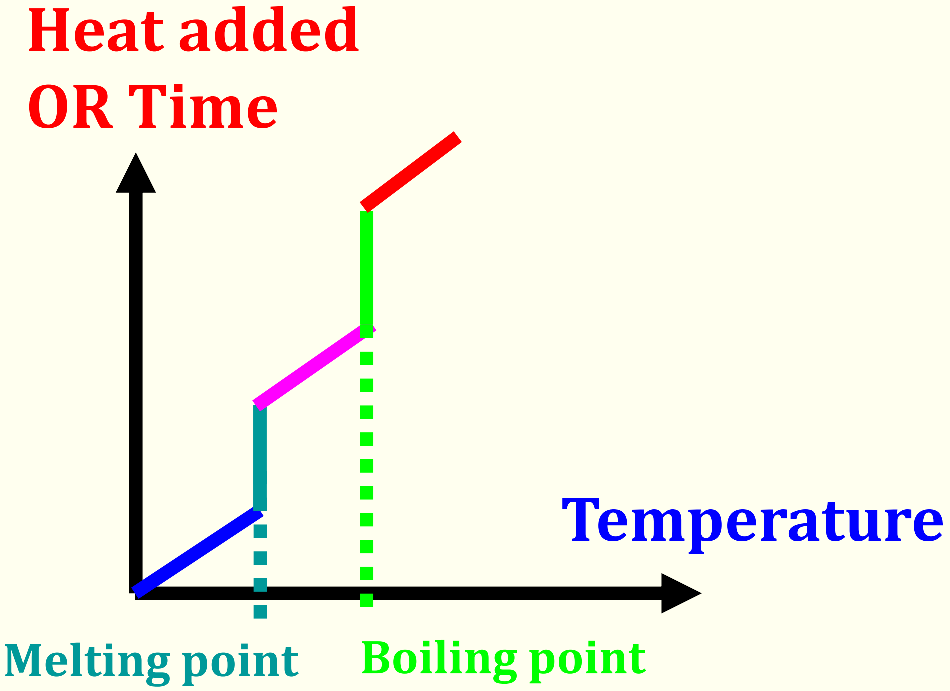




3. Type of Axis

So axis FLIPPING just means invert the whole graph … The boiling/ melting point is now on x axis. All values remain same for both graphs.

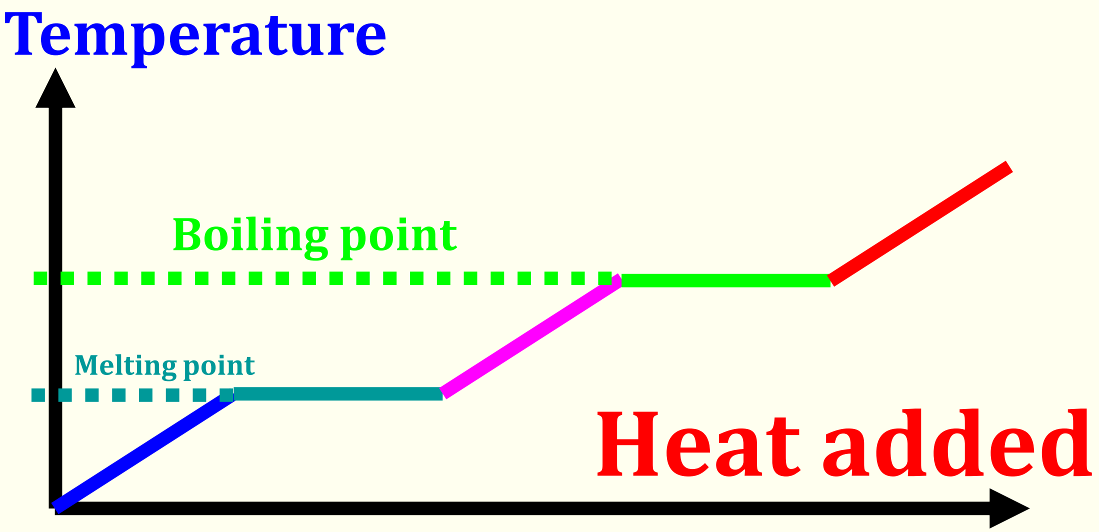


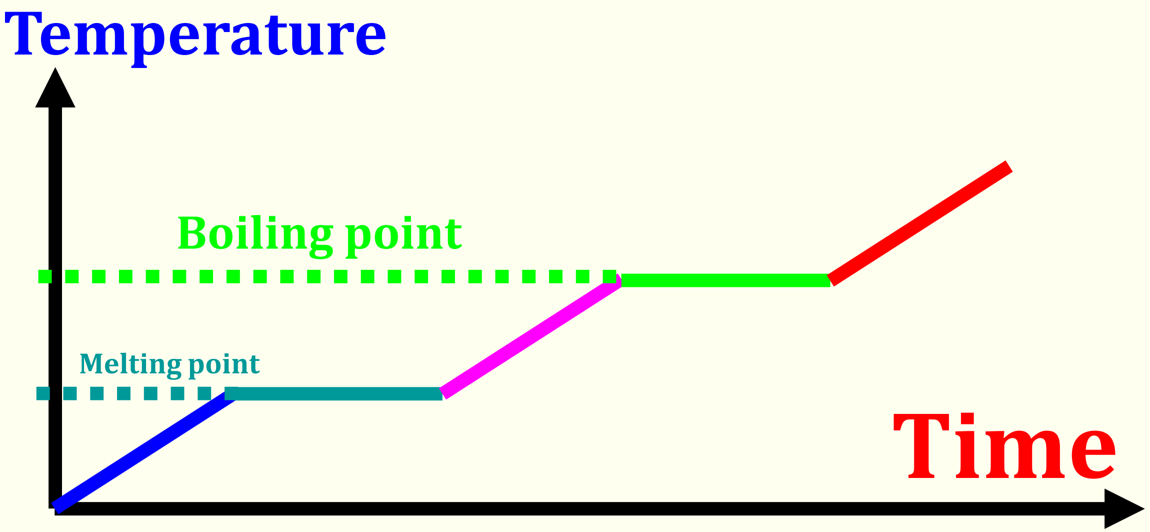


3. Type of Axis

Second issue: time = heat added (compare x axis of both graphs below)

They are different (time vs heat added) but both graphs look exactly the same!!! That means time = heat added… why?





3. Type of Axis

Second issue: **Why time = heat added???**

Energy (or Heat) = Power x Time → (Remember: $E = Pt$)

(if using heater with constant power P) then $E = Pt$ becomes $E \propto t$

Energy is directly proportional to time

So it doesn't change the graph SHAPE whether we call it E or t

Even simpler, suppose power = P = 1, then E = t…

Now we return to the questions!!!

14.1 Matter & Thermal Energy

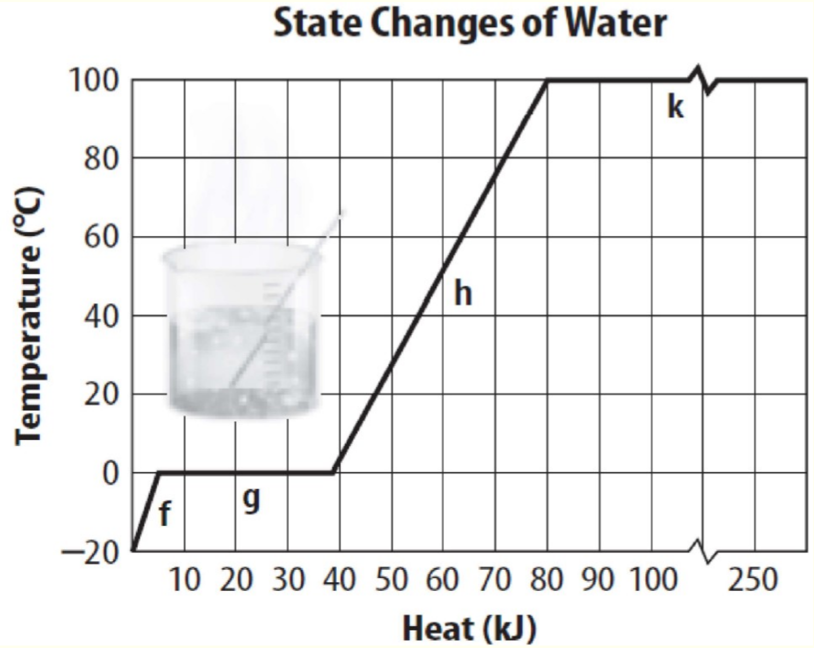
1. At which portion(s) on the graph below is the average kinetic energy of the water molecules increasing?

A) (f) and (h).

B) (g) and (k).

C) (g) only.

D) (k) only.



(162 Major 2, Q14)

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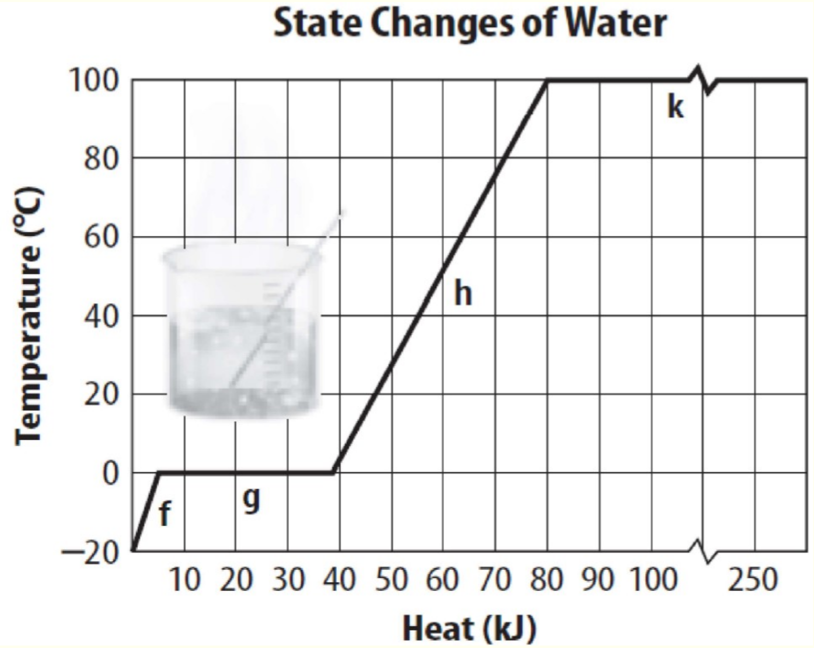
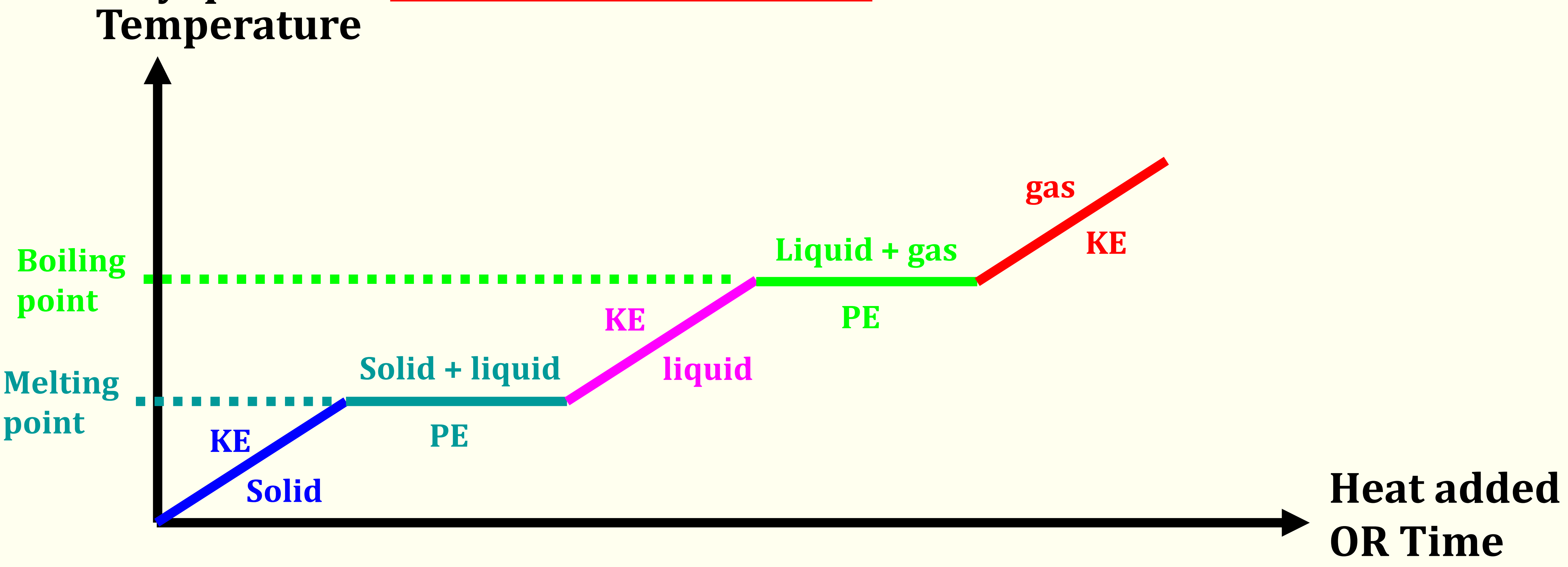


(162 Major 2, Q14)

1 & 2. State of Matter + Type of Energy

We use this figure and notice that KE is increasing in (f) and (h). Take note that the last line is not shown in this question, so NOT all 5 lines will always be shown in every question. **Be careful of this!!!**



14.1 Matter & Thermal Energy

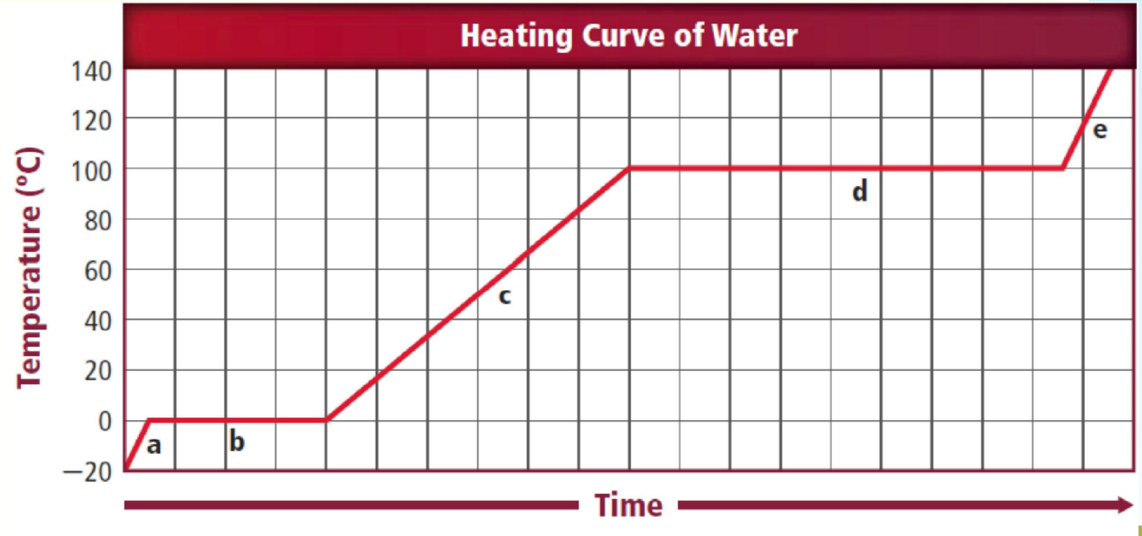
2. A student continuously heated a 1.0-kg of ice until it turned to steam and graphed the change in temperature over time as in the figure below. How would this graph be different if 0.5 kg of ice were being heated?

A) The time of heating will be doubled.

B) The time of heating will be halved.

C) No change will occur.

D) The boiling point and the melting point will be halved.



(152 Major 2, Q5)

14.1 Matter & Thermal Energy

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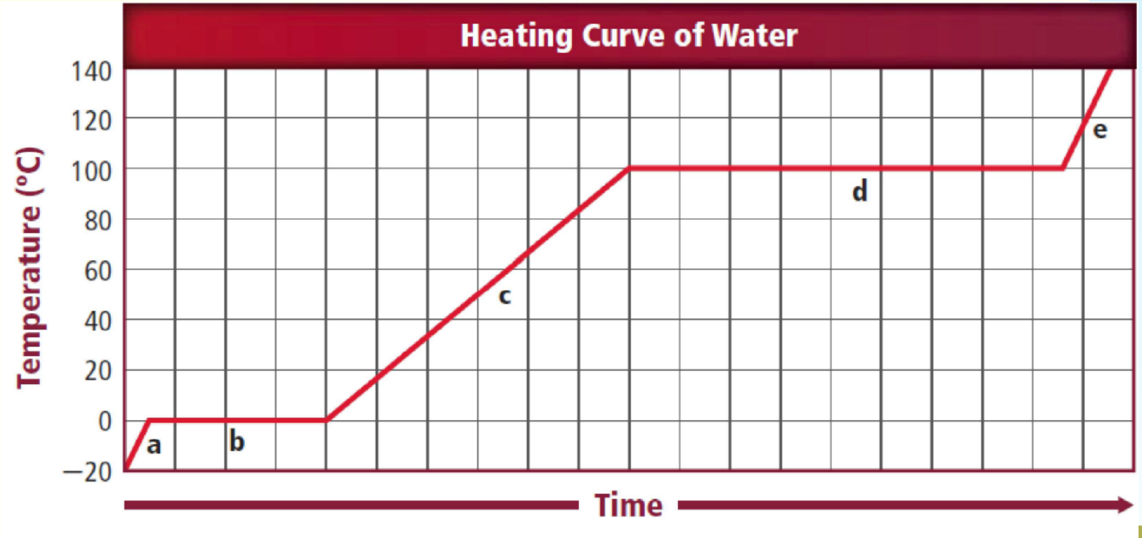


(152 Major 2, Q5)

3. Type of Axis

Remember...

Energy (or Heat) = Power x Time.

This is Energy <u>from heater</u>. Energy <u>from heater</u> is <u>going into ice</u> (i.e. it becomes <u>energy of ice. As the ice melts, it's energy increases</u>).

Assuming no heat loss to environment:

Energy <u>from heater</u> = Energy <u>of ice</u>

3. Type of Axis

Energy from heater = Energy of ice

Energy from heater = Power x Time = Pt

Energy of ice = mass x heat of fusion = mL_f

i.e. $Pt = mL_f$.

Now, P and L_f are constants, so we write:

$Pt = mL_f \rightarrow t \propto m$ (The rule: all CONSTANTS DISAPPEAR!!!)

So t is directly proportional to m

If m (mass) is halved, then t (time) is halved.

14.1 Matter & Thermal Energy

3. The following graph shows the heating curve of one gram of water. In which portion(s) the state of water changes?

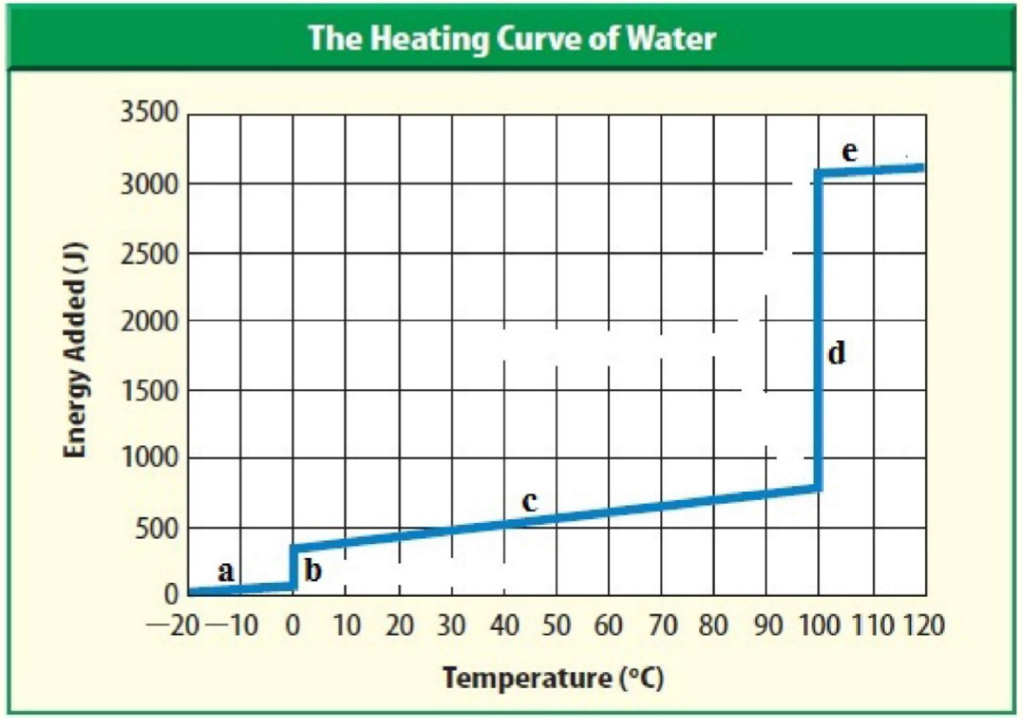
A) In (b) and (d).

B) In (a), (c), and (e).

C) Only in (c).

D) In (a) and (d).

E) In (b) and (e).



(142 Major 2, Q1)

14.1 Matter & Thermal Energy

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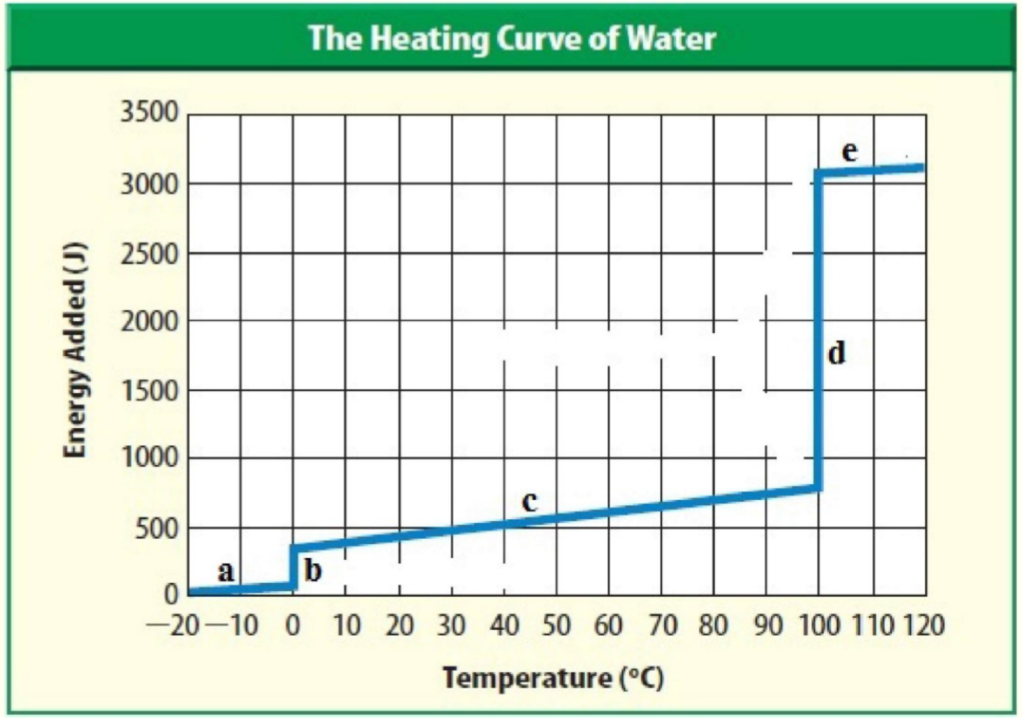
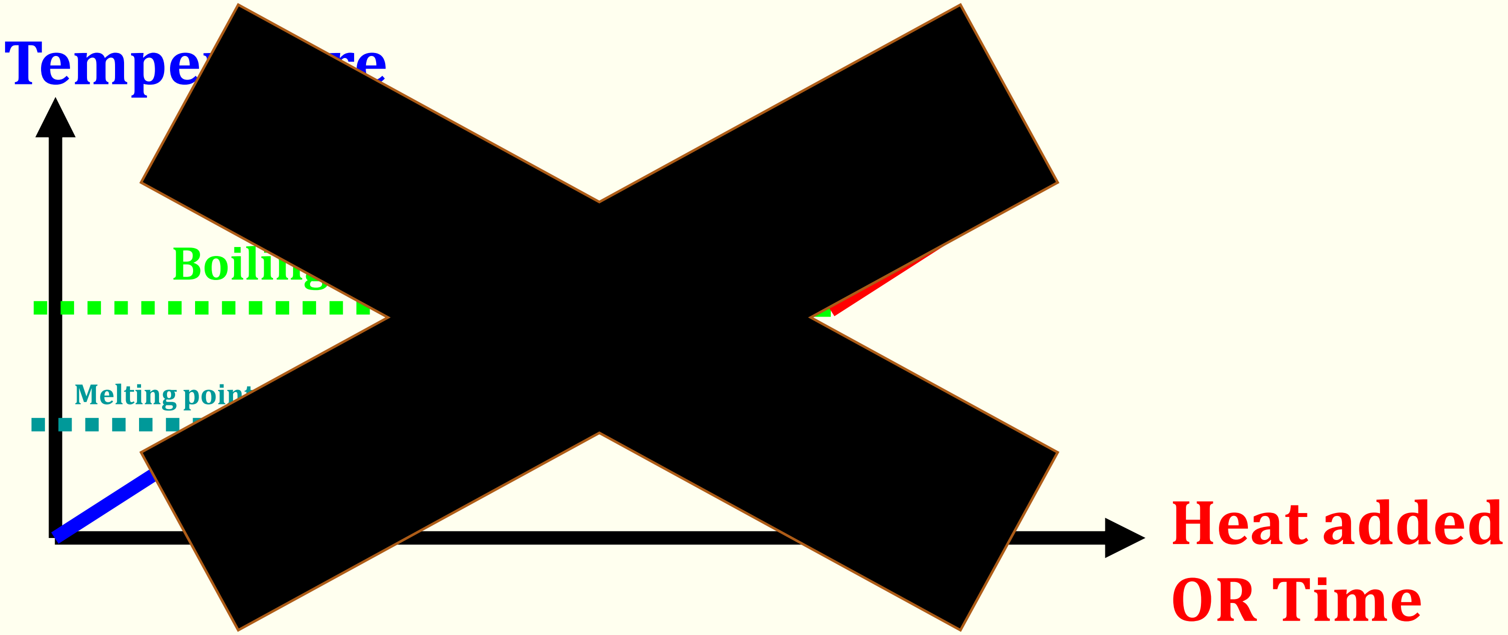
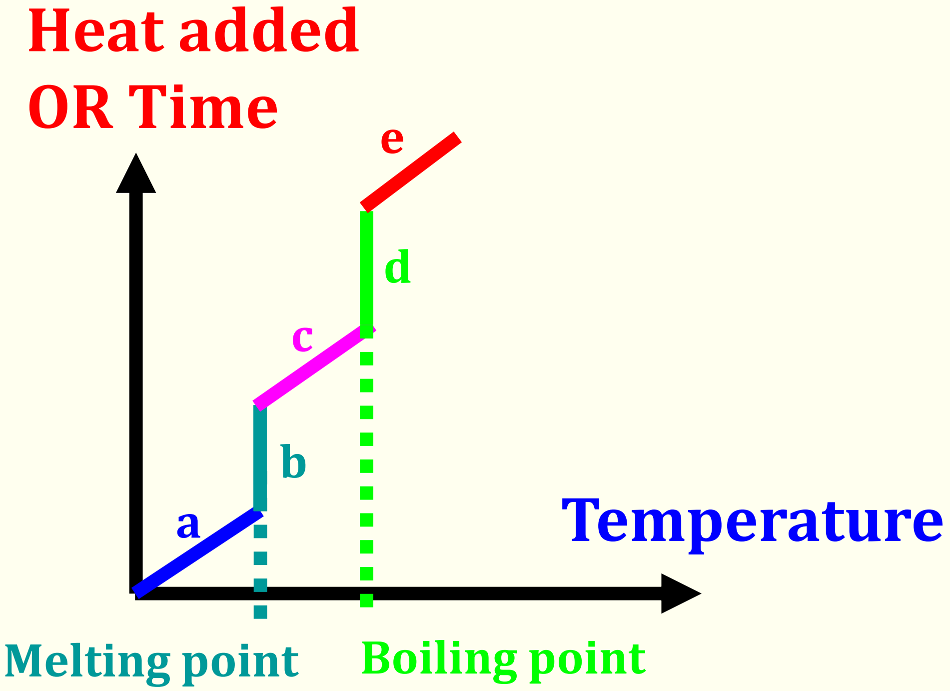


(142 Major 2, Q1)

3. Type of Axis

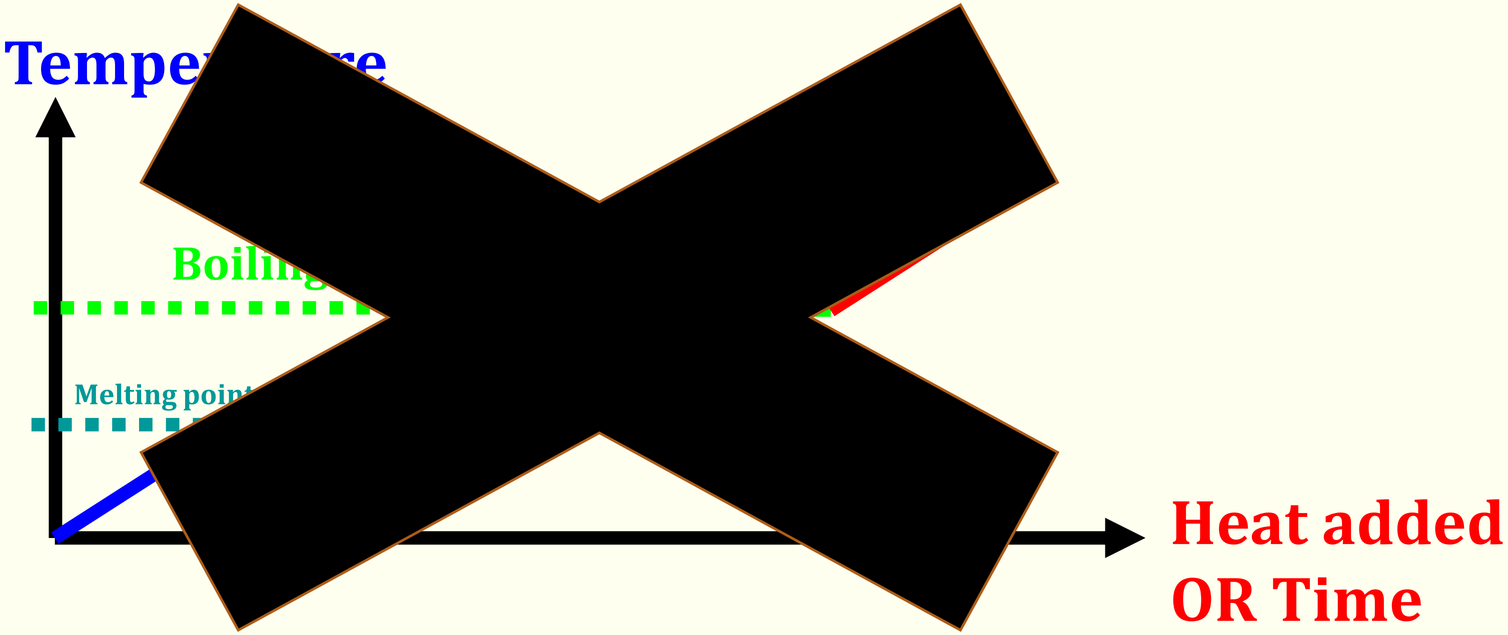
Look carefully at this figure, and the question is asking for the figure on the right. Just know that energy = heat added.

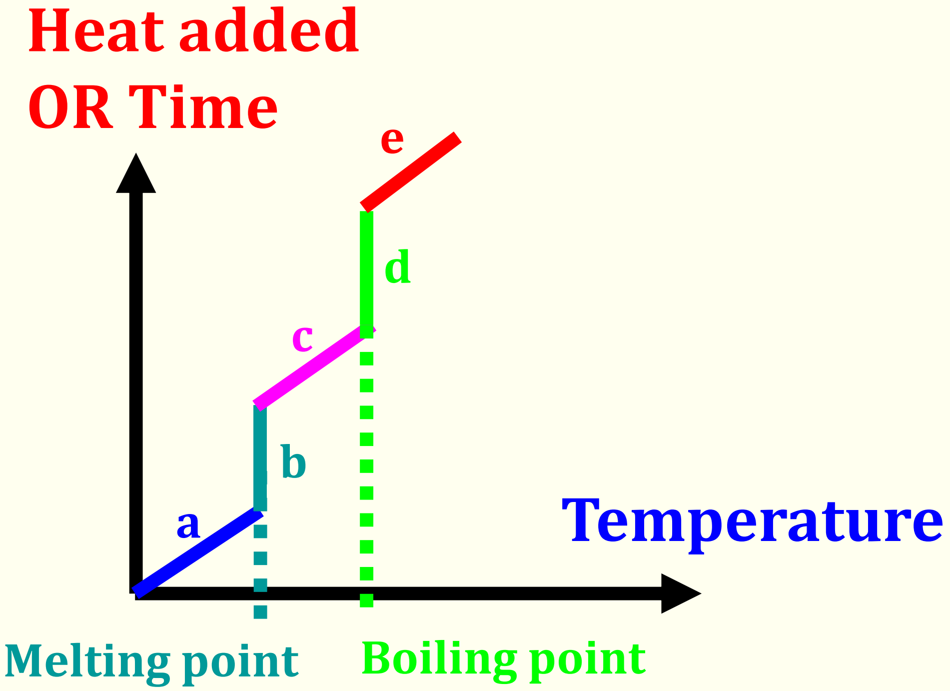




3. Type of Axis

The state of water changes in the (b) melting point (solid → liquid) and (d) boiling point (liquid → gas) i.e. (b) and (d).





14.1 Matter & Thermal Energy

4. The melting point of benzene is 5.5ºC and its boiling point is 80.1ºC. At what temperature will both solid and liquid be present?

A) At temperatures greater than 5.5ºC but less than 80.1ºC.

B) At temperatures less than 5.5ºC.

C) At 5.5ºC.

D) At 80.1ºC.

(171 Major 2, Q10)

14.1 Matter & Thermal Energy

4. The melting point of benzene is 5.5ºC and its boiling point is 80.1ºC. At what temperature will both solid and liquid be present?

A) At temperatures greater than 5.5ºC but less than 80.1ºC.

B) At temperatures less than 5.5ºC.

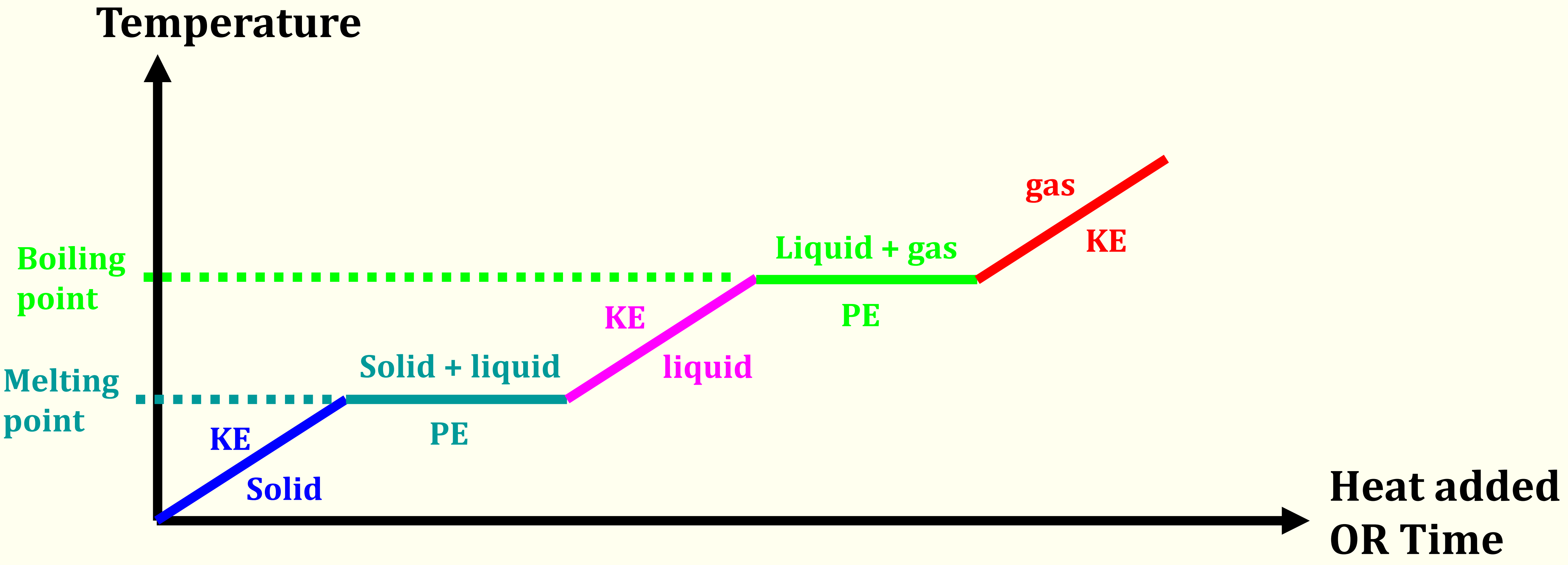
C) At 5.5ºC.

D) At 80.1ºC.

(171 Major 2, Q10)

1 & 2. State of Matter + Type of Energy

Again, we use this figure and notice that both Solid + liquid is present at the Melting point i.e. at 5.5 ^{o}C.



14.1 Matter & Thermal Energy

5. When pure water boils, you can see bubbles rising to the surface of the water. Of what are these bubbles made?

A) Carbon dioxide gas.

B) Water vapor.

C) Air.

D) Oxygen gas.

(171 Major 2, Q11)

14.1 Matter & Thermal Energy

5. When pure water boils, you can see bubbles rising to the surface of the water. Of what are these bubbles made?

A) Carbon dioxide gas.

B) Water vapor.

C) Air.

D) Oxygen gas.

(171 Major 2, Q11)

14.1 Matter & Thermal Energy

6. Which is the term for the amount of energy required for 1 kg of a liquid at its boiling point to become a gas?

A) Heat of fusion.

B) Thermal energy.

C) Temperature.

D) None of these.

(162 Major 2, Q11)

14.1 Matter & Thermal Energy

6. Which is the term for the amount of energy required for 1 kg of a liquid at its boiling point to become a gas?

A) Heat of fusion.

B) Thermal energy.

C) Temperature.

D) None of these.

(162 Major 2, Q11)

14.1 Matter & Thermal Energy

the term for the amount of energy required for 1 kg of a liquid at its boiling point to become a gas

= heat of vaporization

so **D) None of these.**

14.1 Matter & Thermal Energy

7. The change of state from liquid to gas which occurs at the surface of a liquid, and can happen at nearly any temperature is called

A) Boiling.

B) Sublimation.

C) Evaporation.

D) Condensation.

(162 Major 2, Q12)

14.1 Matter & Thermal Energy

7. The change of state from liquid to gas which occurs at the surface of a liquid, and can happen at nearly any temperature is called

A) Boiling.

B) Sublimation.

C) Evaporation.

D) Condensation.

(162 Major 2, Q12)

14.1 Matter & Thermal Energy

- Now we summarise the differences between Evaporation and Boiling

	Evaporation	Boiling
Where it happens?	Only on Surface	Throughout entire liquid
What temperature?	At any temperature	At boiling point
How fast?	Slow	Fast
Any bubbles?	No bubbles form	Many bubbles form

14.1 Matter & Thermal Energy

These properties: occurs at the surface of a liquid, and can happen at nearly any temperature are all properties of evaporation, so answer is evaporation.

14.1 Matter & Thermal Energy

8. What do boiling and evaporation have in common?

A) A change of state from gas to liquid.

B) Bubbles form within a liquid.

C) Occur at specific boiling point.

D) None of these.

(152 Major 2, Q6)

14.1 Matter & Thermal Energy

8. What do boiling and evaporation have in common?

A) A change of state from gas to liquid.

B) Bubbles form within a liquid.

C) Occur at specific boiling point.

D) None of these.

(152 Major 2, Q6)

14.1 Matter & Thermal Energy

Remember! The ONLY thing in common between boiling and evaporation is they both have same state change (liquid → gas). So all the answers are wrong.

14.1 Matter & Thermal Energy

9. Which of the following changes of state can be identified as only evaporation?

A) A shallow pond dries up in the summer.

B) At 100 ºC, the water in a pan changes to steam.

C) Dry ice in an ice-cream cart disappears.

D) Snow on the ground turns to liquid water.

(161 Major 2, Q6)

14.1 Matter & Thermal Energy

9. Which of the following changes of state can be identified as only evaporation?

A) A shallow pond dries up in the summer.

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C) Dry ice in an ice-cream cart disappears.

D) Snow on the ground turns to liquid water.

(161 Major 2, Q6)

14.1 Matter & Thermal Energy

- Look carefully at this table.

	From the question	What state change occur?	What it's called?
(a)	shallow pond dries up in the summer.	liquid → gas	Evaporation (because it happens at normal air temperature)
(b)	At 100 ºC, the water in a pan changes to steam.	liquid → gas	Boiling (because it happens at 100 ºC = fixed boiling point)
(c)	Dry ice in an ice-cream cart disappears	solid → gas	sublimation
(d)	Snow on the ground turns to liquid water	solid → liquid	melting

14.1 Matter & Thermal Energy

10. Which of the following changes of state releases thermal energy?

A) Vaporization

B) Melting

C) Condensation

D) Sublimation

(161 Final, Q24)

14.1 Matter & Thermal Energy

10. Which of the following changes of state releases thermal energy?

A) Vaporization

B) Melting

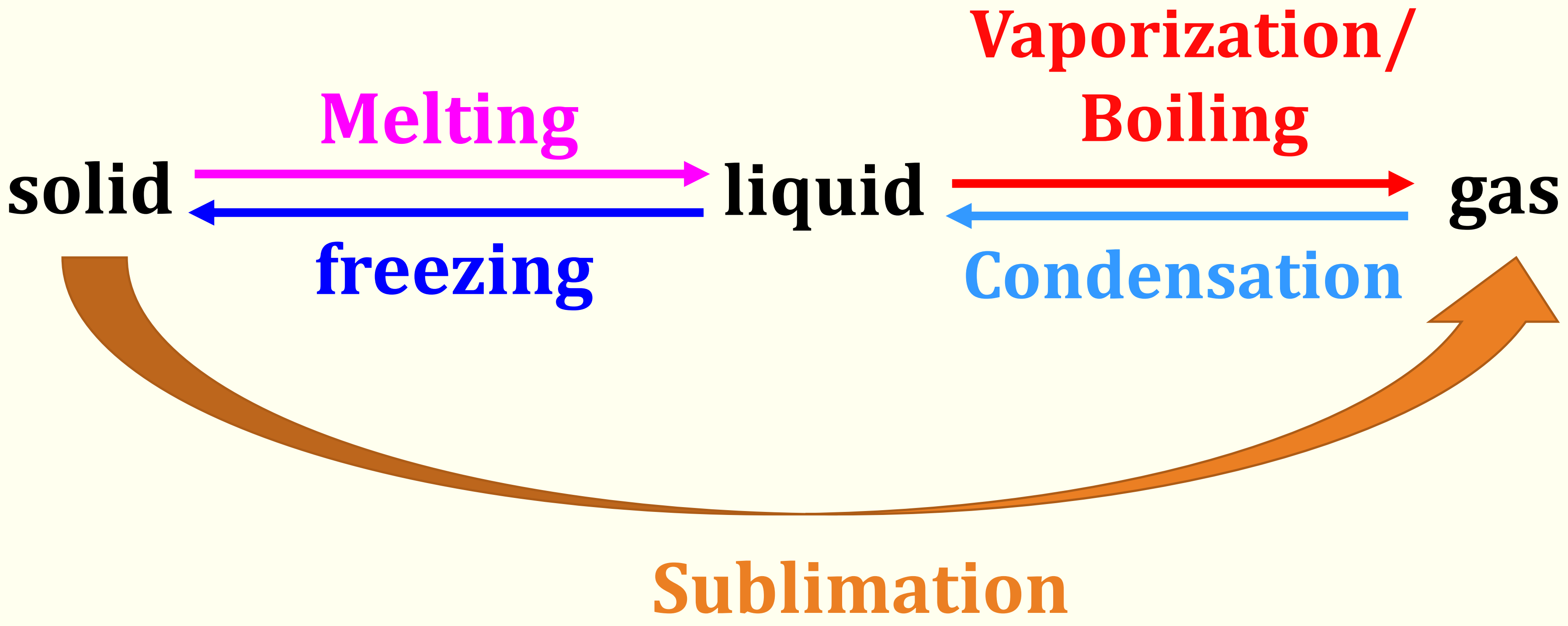
C) Condensation

D) Sublimation

(161 Final, Q24)

14.1 Matter & Thermal Energy

First, let us sumarise all the processes ...



14.1 Matter & Thermal Energy

How much energy does each state have?

	How much energy?	Why?
Solid	Lowest	Particles only vibrate about fixed position
Liquid	Medium	Particles free to move, but confined to body of liquid (i.e. can't escape from liquid surface)
Gas	Highest	Particles completely free to move, in all direction, at very fast speeds

14.1 Matter & Thermal Energy

If we go from lower to higher energy, we add energy.

If we go from higher to lower energy, we release energy.

All this can be summarise like this:

$$\underset{\text{(lowest)}}{\text{solid}} \underset{\text{release}}{\overset{\text{add}}{\rightleftharpoons}} \underset{\text{(medium)}}{\text{liquid}} \underset{\text{release}}{\overset{\text{add}}{\rightleftharpoons}} \underset{\text{(highest)}}{\text{gas}}$$

14.1 Matter & Thermal Energy

11. Condensation is an example of a

A) physical change.

B) chemical change.

C) physical property.

D) chemical property.

(152 Major 2, Q15)

14.1 Matter & Thermal Energy

11. Condensation is an example of a

A) physical change.

B) chemical change.

C) physical property.

D) chemical property.

(152 Major 2, Q15)

14.1 Matter & Thermal Energy

- Condensation is a process, that involve changing from the gas to liquid state, so it is a change.
- It does not produce any new substances or products, so it is a physical change not chemical change

14.1 Matter & Thermal Energy

12. Which has the greater amount of thermal energy, one liter of water at 50ºC or two liters of water at 50ºC?

A) Two liters of water at 50ºC.

B) One liter of water at 50ºC.

C) Both have equal amount of thermal energy.

D) Not enough information.

(162 Major 2, Q13)

14.1 Matter & Thermal Energy

12. Which has the greater amount of thermal energy, one liter of water at 50ºC or two liters of water at 50ºC?

A) Two liters of water at 50ºC.

B) One liter of water at 50ºC.

C) Both have equal amount of thermal energy.

D) Not enough information.

(162 Major 2, Q13)

14.1 Matter & Thermal Energy

A molecule has 2 types of thermal energy (KE + PE)

Total thermal energy of a molecule = KE + PE

KE = movement of molecule flying about (Temp. $\propto$ KE)

PE = attractive force on molecule by other molecule (depends on state)

14.1 Matter & Thermal Energy

Since both water have same temperature, they have same KE

Since both water have same state, they have same PE

So thermal energy (KE+ PE) per molecule is same for both water

Total thermal energy = no. of molecules x thermal energy per molecule

Since 2 liters of water has double the molecules as 1 liter of water, then 2 liters of water has double the thermal energy as 1 liter of water

14.1 Matter & Thermal Energy

13. In which case the average kinetic energy of water molecules is larger: a swimming pool of boiling water or a cup of boiling water?

A) The swimming pool because the molecules make more collisions.

B) The swimming pool because more bubbles are formed in the pool.

C) The average kinetic energy of molecules in each is the same.

D) The cup because the molecules hit the cup’s inner surface more often.

(151 Major 2, Q12)

14.1 Matter & Thermal Energy

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C) The average kinetic energy of molecules in each is the same.

D) The cup because the molecules hit the cup's inner surface more often.

(151 Major 2, Q12)

2. Type of Energy

A molecule has 2 types of thermal energy (KE + PE)

Total thermal energy of a molecule = KE + PE

KE = movement of molecule flying about (Temp. $\propto$ KE)

PE = attractive force on molecule by other molecule

So if temperature is same, then average KE is also same.

14.1 Matter & Thermal Energy

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(161 Major 2, Q7)

14.1 Matter & Thermal Energy

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(161 Major 2, Q7)

14.1 Matter & Thermal Energy

A molecule has 2 types of thermal energy (KE + PE)

Total thermal energy of a molecule = KE + PE

KE = movement of molecule flying about (Temp. $\propto$ KE)

PE = attractive force on molecule by other molecule

So if temperature is same, then average KE is also same.

14.1 Matter & Thermal Energy

15. Which is unlikely to contain plasma?

A) A cloud.

B) A star.

C) A lightning bolt.

D) A neon light.

(152 Major 2, Q7)

14.1 Matter & Thermal Energy

15. Which is unlikely to contain plasma?

A) A cloud.

B) A star.

C) A lightning bolt.

D) A neon light.

(152 Major 2, Q7)

14.1 Matter & Thermal Energy

- A plasma is an ionized gas (very very hot gas until the gas atom lose its electrons).
- to ionize a gas, you need <u>very high temperature</u>.
- so look for answers that involve very strong energy sources (nuclear/electricity)
- Only clouds do not have any strong energy sources (high temperature or electricity or nuclear), so they do not have enough energy to produce a plasma

14.1 Matter & Thermal Energy

Now, study the various answers:

A) A cloud – roughly 10 – 20 °C. Nothing with very high temperature or energy in a cloud.

B) A star – very high temperatures by nuclear fusion

C) lightning bolt – very high temperatures by electric current

D) A neon light – high temperatures by electric current

(152 Major 2, Q7)

14.1 Matter & Thermal Energy

16. Which of the following expands most when the temperature is lowered? Equal volumes of

A) water at 4.0°C.

B) iron at 25°C.

C) helium at 5.0°C.

D) none expand when the temperature is lowered.

(162 Major 2, Q19)

Density of Water

- **Alright, now we spend the next few pages discussing in detail the:**

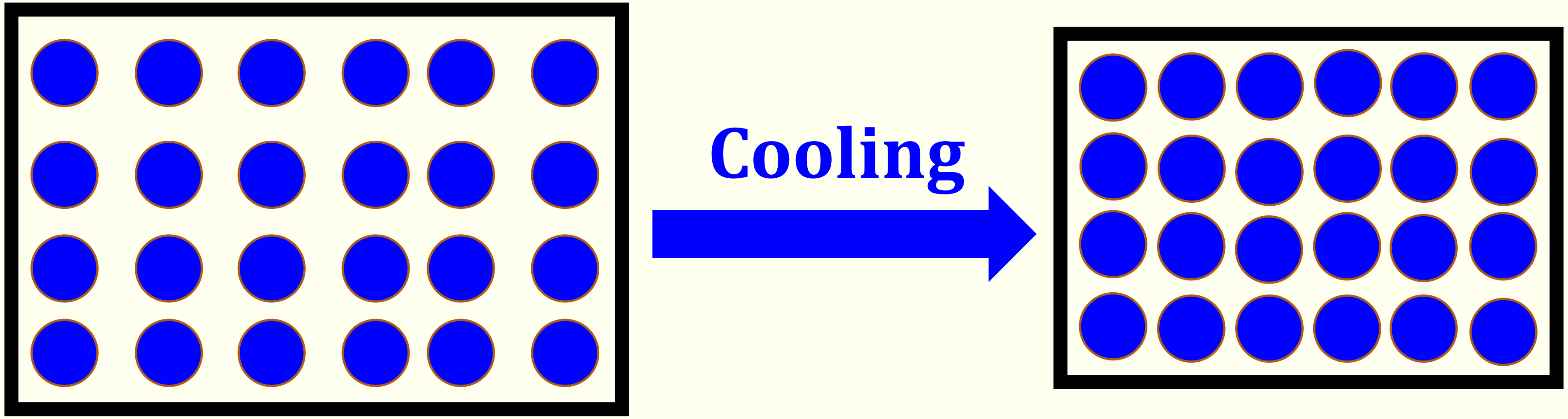
special properties of density of water near 4 °C.

- **Please try to understand everything clearly, and revise as many times if you need, then start answering the questions after that.**

Density of Water

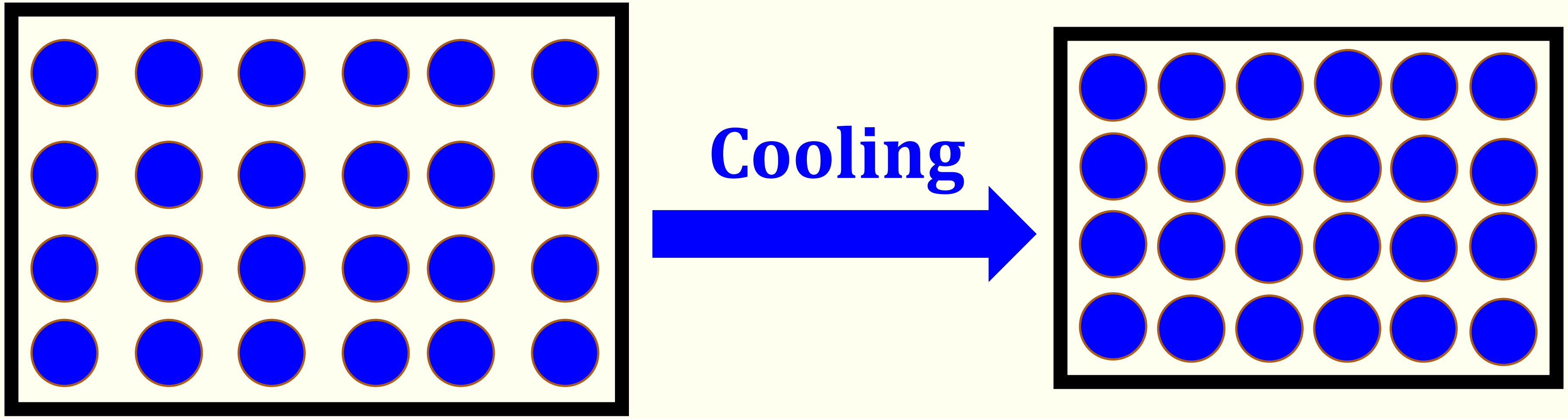
Liquid water is a very special substance.

For most objects, when they become colder, they atoms slow down and come closer. So as temperature decreases, the object contracts (volume decrease, density increase) like this:



Density of Water

Just take note: upon cooling, the size of atoms ● remain exactly the same. what happens is the atoms squeeze closer together because their kinetic energy decreases so they vibrate with smaller speed. So the entire object's volume decrease and density increase upon cooling, but each atom still same size.



Density of Water

But for liquid water, as it cools it behaves in very special way:

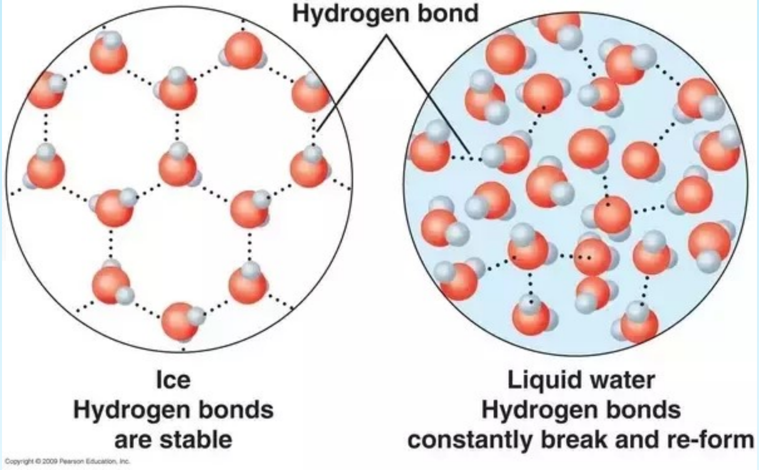
If you cool liquid water down from 100 °C → 4 °C, it has normal behaviour like previous page.

It contracts, volume decreases and density increase due to reason just mentioned (atoms squeeze closer together).

Density of Water

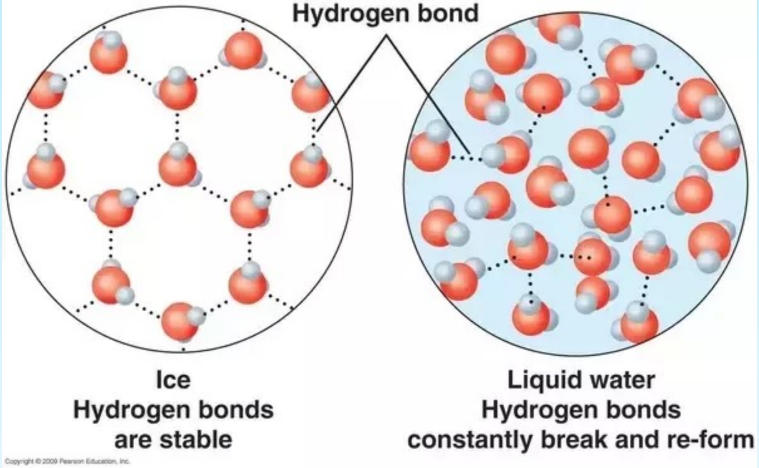
But if you continue cooling liquid water from 4 °C → 0 °C, it has very special and strange behaviour.

It expands, volume increases and density decrease



Density of Water

Because below 4 °C, strong hydrogen bonds form and they make the atoms become further apart from each other . (Remember that atoms must come closer together for density to increase) These hydrogen bonds cause volume to increase (see figure – left one has more volume than right one) & so the density will decrease for 4 °C → 0 °C

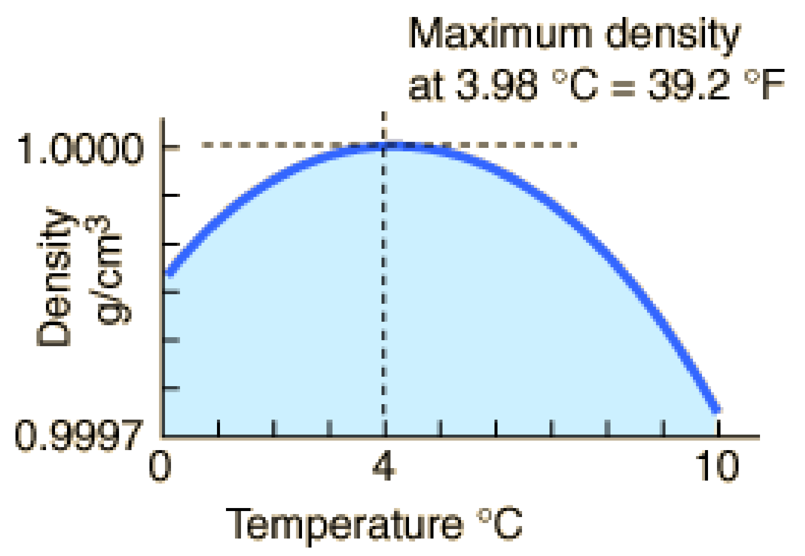


Density of Water

So now we can summarise the complete behaviour of liquid water from 100 °C to 0 °C in this table:

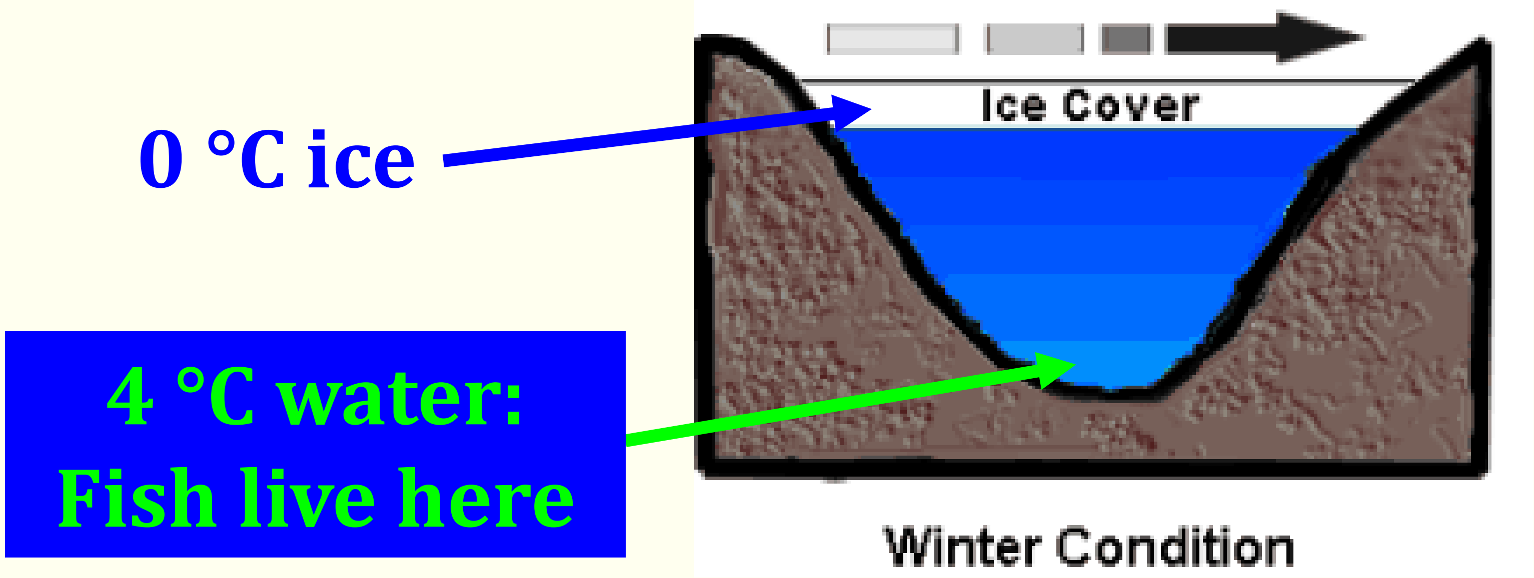
Temperature	Density	Volume	Behavior
100 °C → 4 °C	increase	decrease	Like normal
4 °C → 0 °C	decrease	increase	Very special

This graph shows the exact behaviour. Notice if you cool, the density keeps increasing and reaches a maximum at 4 °C. after that the density will decrease. So water has highest density at 4 °C.



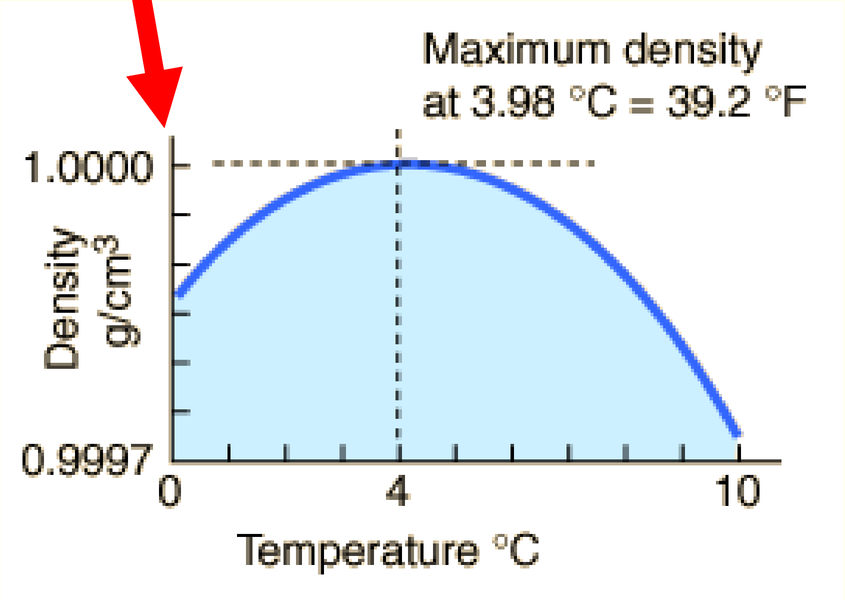
Density of Water

And we know that denser objects will sink. so this means in winter, all the 4 °C water will sink to the bottom of a river as it has highest density. and the bottom can be 4 °C even if the top layer of river is frozen. So the fish can live safely near the bottom of the river without freezing.



Density of Water

The last trick: be careful whether the y axis is labelled density (left) or volume (right): density ∝ 1/volume, so they are Inversely related to each other



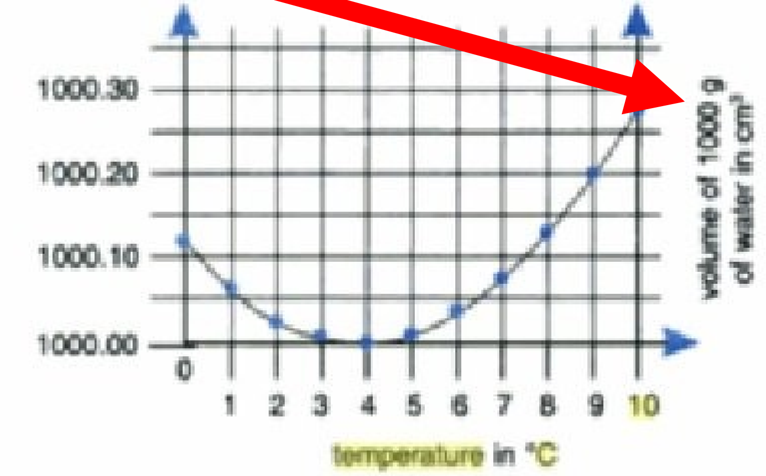
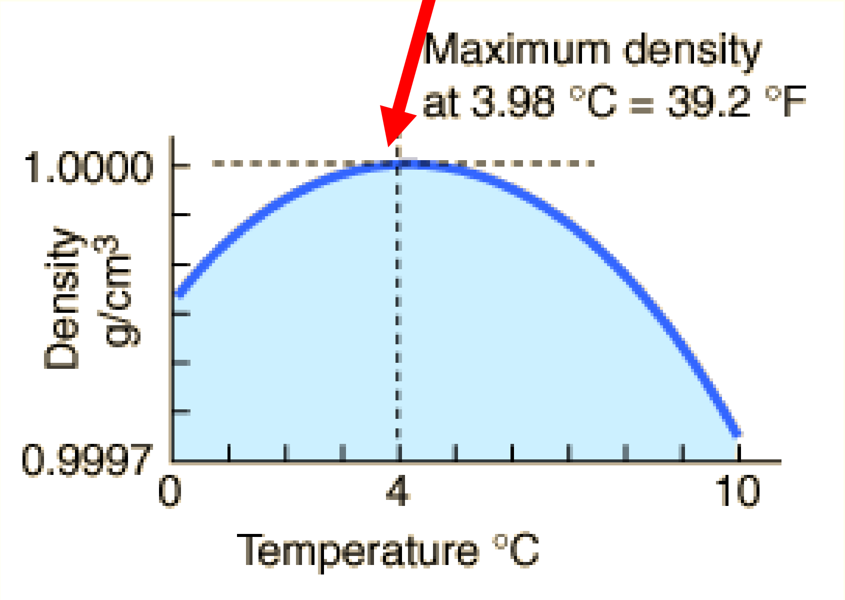


Fig. 9.15b Graph for anomalous expansion of water

Density of Water

For density, we have maximum and for volume we have a minimum at ~ 4 °C. After this, we look at the questions.



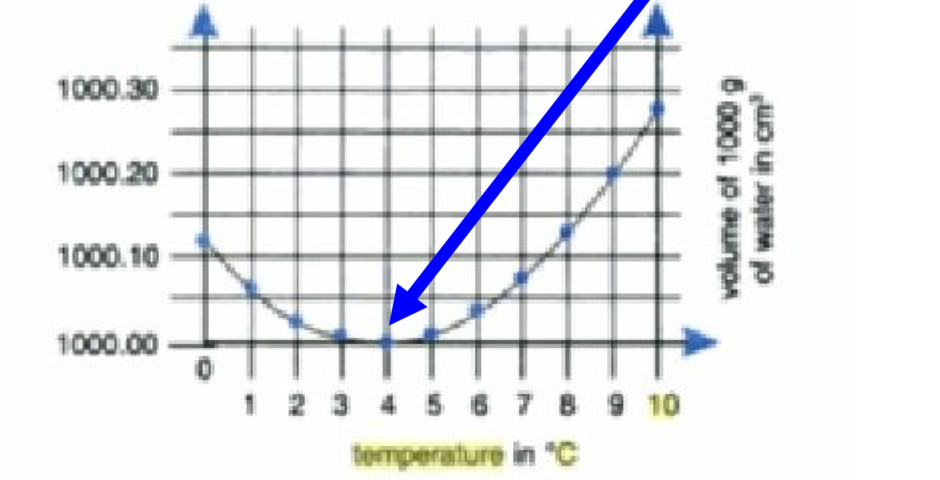


Fig. 9.15b Graph for anomalous expansion of water

14.1 Matter & Thermal Energy

16. Which of the following expands most when the temperature is lowered? Equal volumes of

A) water at 4.0°C.

B) iron at 25°C.

C) helium at 5.0°C.

D) none expand when the temperature is lowered.

(162 Major 2, Q19)

14.1 Matter & Thermal Energy

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A) water at 4.0°C.

B) iron at 25°C.

C) helium at 5.0°C.

D) none expand when the temperature is lowered.

(162 Major 2, Q19)

14.1 Matter & Thermal Energy

In general, almost all objects contract when cooled.

the special exception is water at 4 °C. it will expand (= volume increase) when cooled from 4 °C to 0 °C.
Just to revise: look at this again. Below 4 °C the water volume increases.

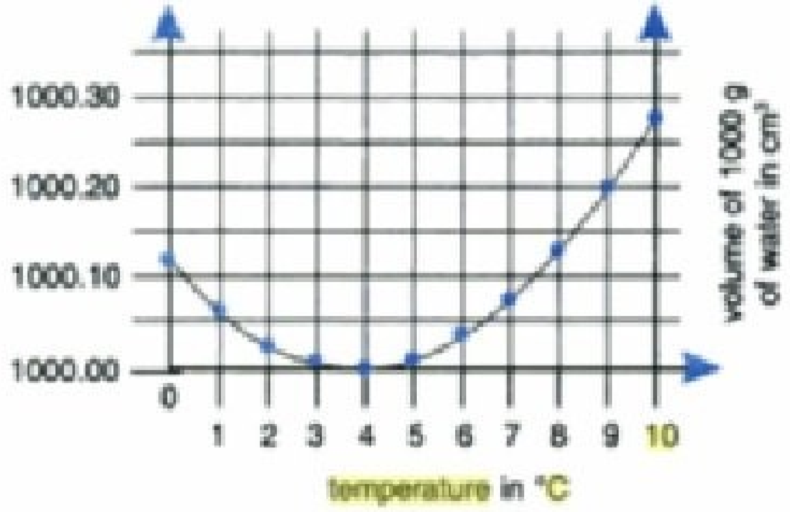


Fig. 9.15b Graph for anomalous expansion of water

14.1 Matter & Thermal Energy

17. Which of the following statements is TRUE?

A) In amorphous solids (like glass) the particles have specific geometric arrangements.

B) Most of the ordinary matter in the universe is in the liquid state.

C) When water freezes its density decreases.

D) Condensation is the change of state from liquid to gas.

(171 Major 2, Q7)

14.1 Matter & Thermal Energy

17. Which of the following statements is TRUE?

A) In amorphous solids (like glass) the particles have specific geometric arrangements.

B) Most of the ordinary matter in the universe is in the liquid state.

C) When water freezes its density decreases.

D) Condensation is the change of state from liquid to gas.

(171 Major 2, Q7)

14.1 Matter & Thermal Energy

Let's look at the options:

A) In amorphous there is <u>NO specific geometric arrangements</u> see p438 middle. It says amorphous solids:

1. **<u>lack</u> a <u>crystalline structure</u> &**
2. **do <u>no</u>t have <u>fixed melting point</u>**

B) Most ordinary matter in universe is plasma – see p436 bottom.

C) When water freezes its density decreases – as we just discussed for several pages – due to strong hydrogen bonds

D) Condensation = gas to liquid.

14.1 Matter & Thermal Energy

18. The density of water

A) increases as you cool water below 4ºC.

B) decreases as you cool water below 4ºC.

C) is always constant.

D) has the highest value at 0ºC.

(151 Major 2, Q5)

14.1 Matter & Thermal Energy

18. The density of water

A) increases as you cool water below 4ºC.

B) decreases as you cool water below 4ºC.

C) is always constant.

D) has the highest value at 0ºC.

(151 Major 2, Q5)

14.1 Matter & Thermal Energy

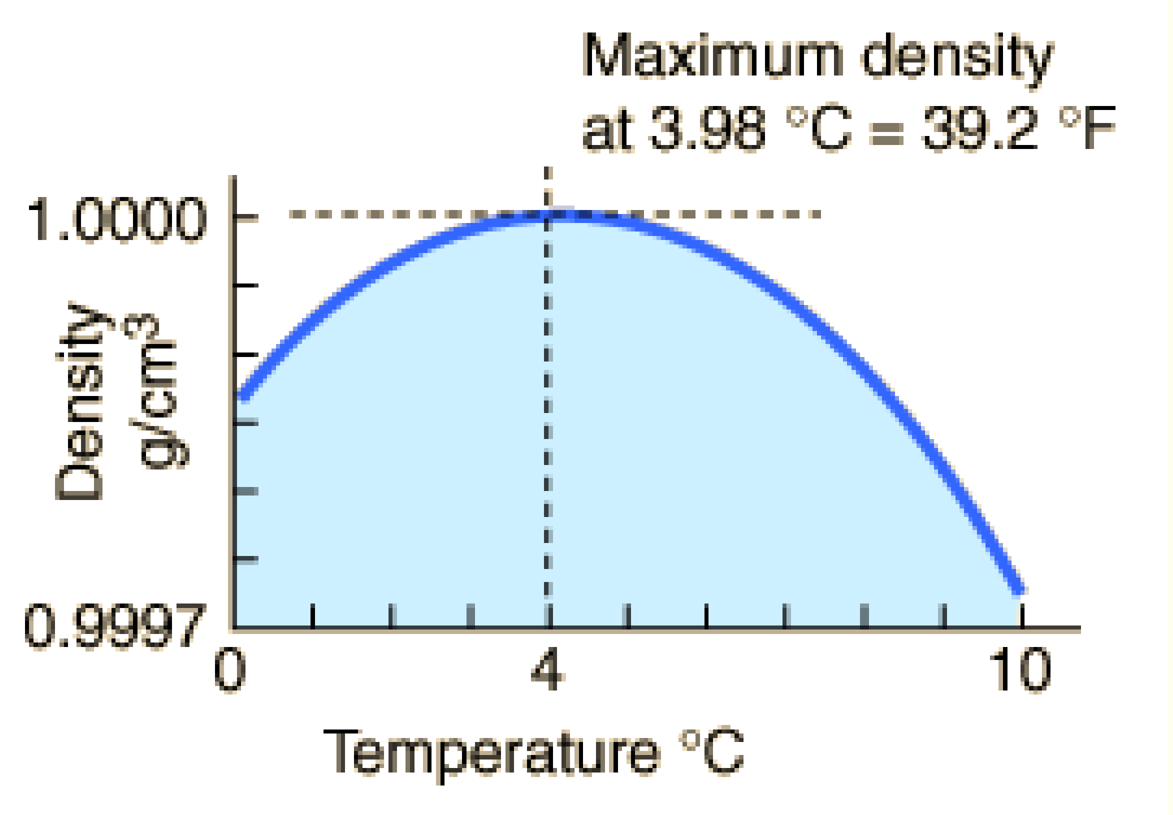
To revise, this is the density graph:

A) wrong

B) yes, density decreases below 4ºC.

C) NO!!!

D) wrong: highest value is at 4 ºC.



14.1 Matter & Thermal Energy

19. Which of the following statements is TRUE

A) Some kinds of solids do not have a specific melting point.

B) Heat of fusion is the energy required to change a substance from liquid to gas at its boiling point.

C) Most of the ordinary matter in the universe is in the gaseous state.

D) Sublimation is the process of a gas changing to liquid.

E) When a liquid crystal melts, it will lose its all ordered geometric arrangement.

(142 Major 2, Q2)

14.1 Matter & Thermal Energy

19. Which of the following statements is TRUE

A) Some kinds of solids do not have a specific melting point.

B) Heat of fusion is the energy required to change a substance from liquid to gas at its boiling point.

C) Most of the ordinary matter in the universe is in the gaseous state.

D) Sublimation is the process of a gas changing to liquid.

E) When a liquid crystal melts, it will lose its all ordered geometric arrangement.

(142 Major 2, Q2)

14.1 Matter & Thermal Energy

A) Yes amorphous solids don't have fixed melting point (p438 bottom).

B) WRONG. Heat of fusion = solid to liquid at melting point.

C) WRONG. Most ordinary matter in universe is plasma – see p436 bottom.

D) WRONG. Sublimation = solid to gas.

E) WRONG. When liquid crystal melts, it will (see p439 top):

1. Start to flow during melting
2. will not lose its ordered arrangement completely,
3. Will retain geometric order in specific directions

14.2 Properties of Fluid

Properties of Fluid

- For this topic "fluid properties," you must **know very well 6 laws**:

1. Archimedes principle
2. principle of buoyancy (floatation)
3. Pressure equation
4. Pascal's principle
5. Bernoulli's principle
6. Viscosity

Now we will briefly discuss these laws then solve the exam questions

1. Archimedes principle

1. Archimedes principle

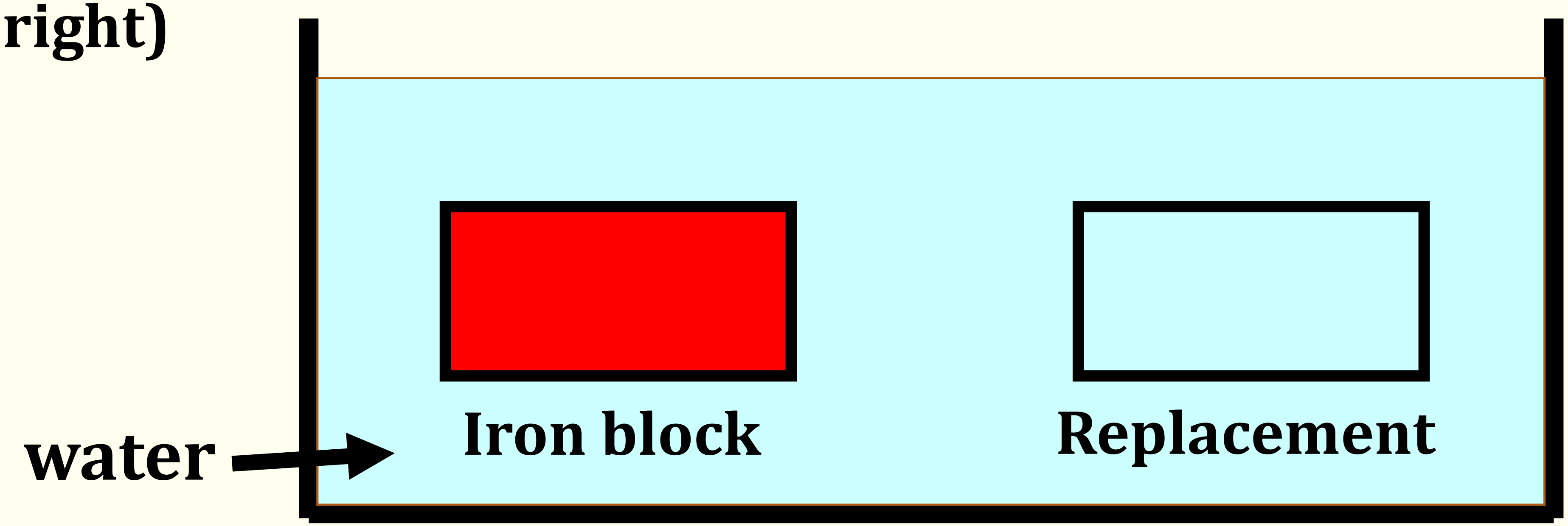
- very simple. if you put an object in a fluid (liquid/gas), it will have an **up**ward force (called **up**thrust).
- The amount of this Force = weight of fluid displaced
- So… You know the force's direction (up) & its amount.
- that's all you need to know for any force to solve questions…
- But sometimes there is confusion:

what the weight of fluid displaced means???

1. Archimedes principle

1. Archimedes principle

- To understand what <u>weight of fluid displaced </u>means, imagine this red iron block submerged completely inside water. Now, imagine you dig out the iron inside, and fill the skin completely with water (see replacement on right)
-



1. Archimedes principle

1. Archimedes principle

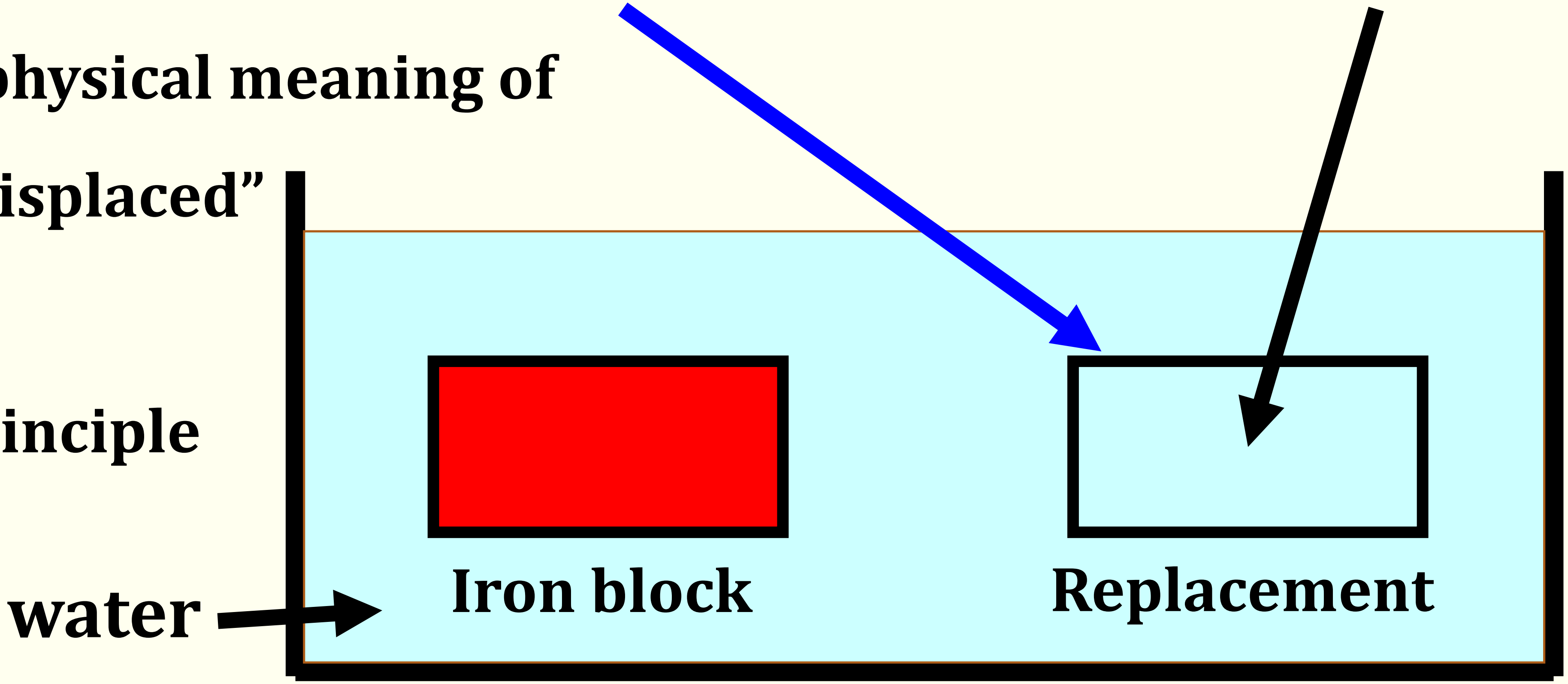
- The weight of the water inside the skin is weight of fluid displaced
- This is the real, physical meaning of

  "weight of fluid displaced"

That's it...

Next we look at Principle

of buoyancy.



21) The Plate Tectonics Theory

2. principle of buoyancy (floatation)

- For an object in a fluid, there are only 2 possibilities:

It floats — It sinks

- If it floats, then either: partially — fully

21) The Plate Tectonics Theory

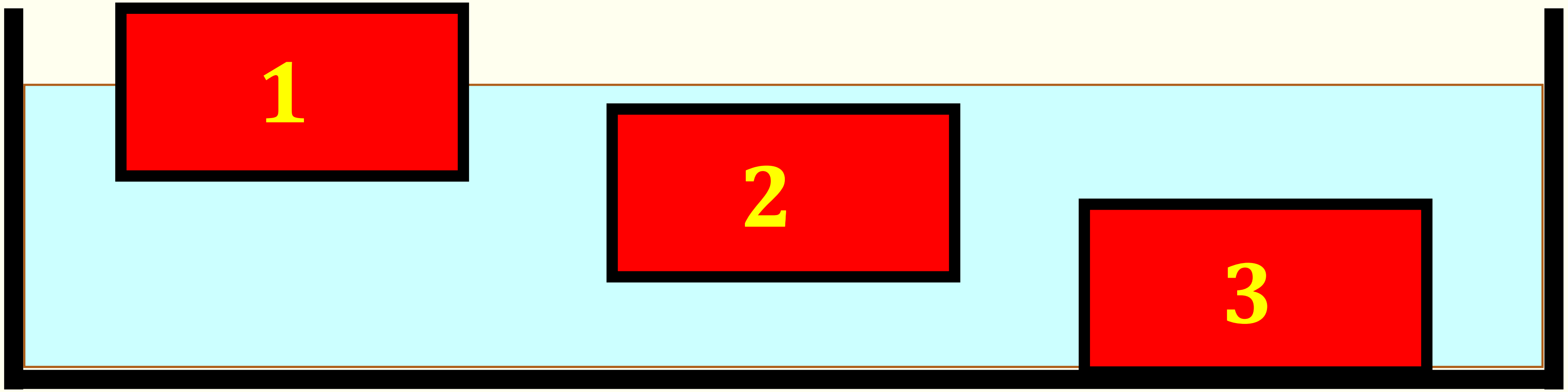
2. principle of buoyancy (floatation)

So in total, for an object in a fluid, there are only **3 simple cases:**

1. Floating, but partially submerged
2. Floating, but fully submerged

Both are considered floating!

3. Sink (fully)



21) The Plate Tectonics Theory

2. principle of buoyancy (floatation)

For case 1 & 2 (Floating is either 1. partially or 2. fully submerged):

In both cases: **<u>Upthrust = weight</u>**

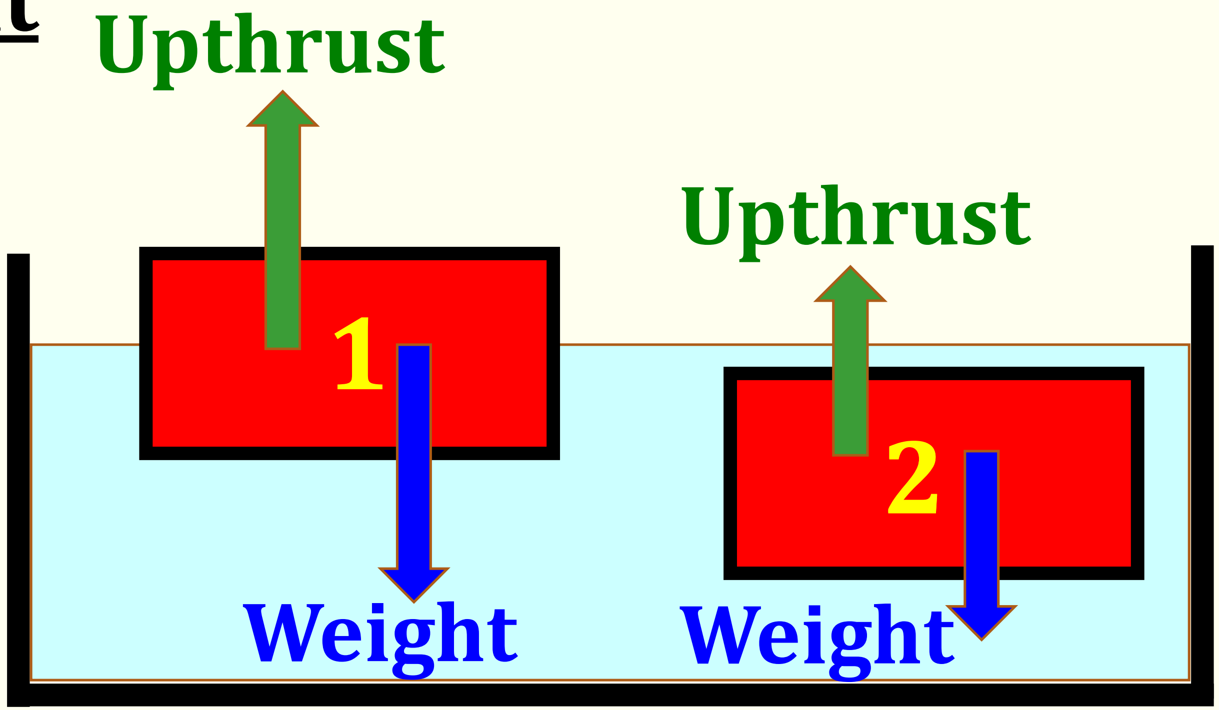
Upthrust force (up) cancels the

Weight/gravitational Force (down)

So Net force = 0

The object doesn't accelerate down

i.e. it floats.



21) The Plate Tectonics Theory

2. principle of buoyancy (floatation)

What is the difference between partially & fully submerged?

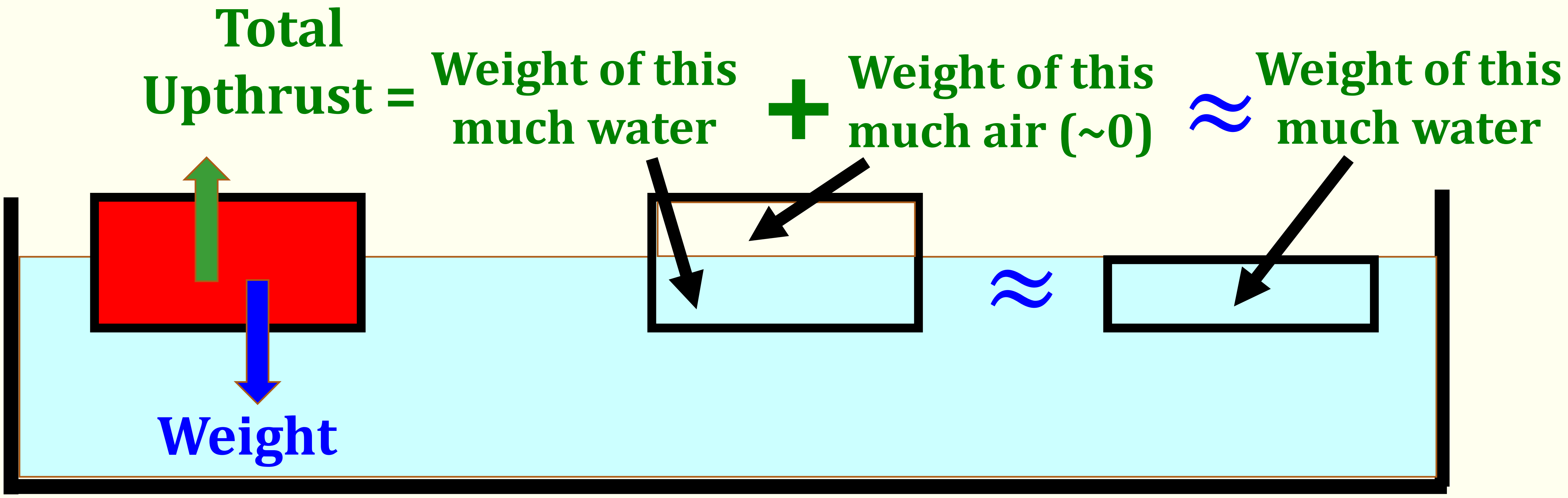
It depends on the density.

If object has low density (object density < fluid density), then it needs to only partially submerge (less upthrust needed) to make upthrust = weight.

IMPORTANT! upthrust is only generated by the part submerged under water. The part exposed in air generates almost no upthrust because air has very low density, so the weight of air displaced is almost 0 (carefully see next pg.)

21) The Plate Tectonics Theory

2. principle of buoyancy (floatation)



21) The Plate Tectonics Theory

2. principle of buoyancy (floatation)

What is the difference between partially & fully submerged?

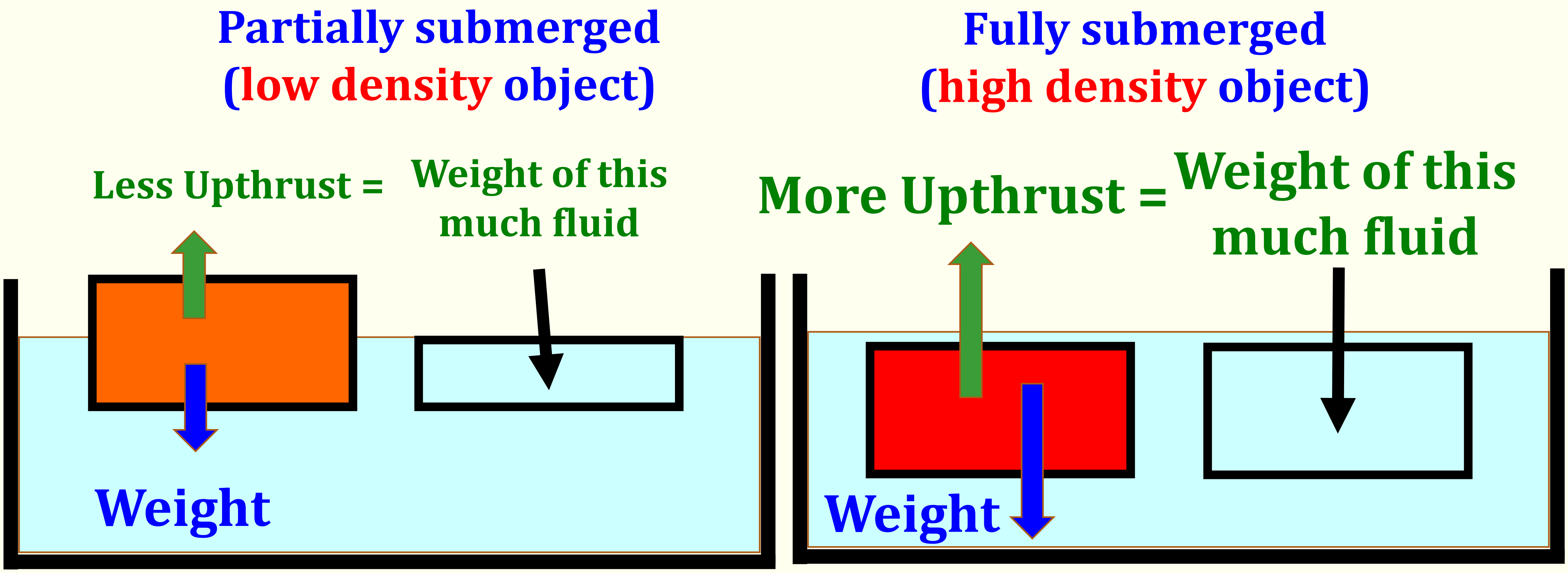
So now we understand this previous point, "Remember! upthrust is only generated by the part submerged under water. the part in air generates almost No upthrust because air has very low density, so the weight of air displaced is almost 0." That's all for case 1.

For case 2: If object density is same as fluid density, then object must fully submerge to produce more upthrust to make upthrust = weight.

Now we compare partially submerged (case 1) vs fully submerge (case 2)

21) The Plate Tectonics Theory

2. principle of buoyancy (floatation)



21) The Plate Tectonics Theory

2. principle of buoyancy (floatation)

For case 3 (fully sink): weight > upthrust

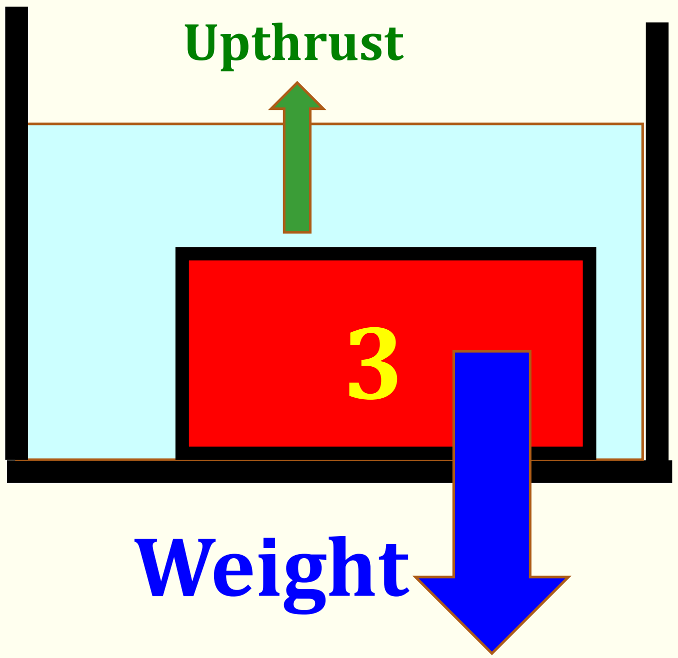
Object has **very high density (> than fluid)**

Weight/gravitational force (down) is **more than** **upthrust** force (up).

So **Net force** is **down**wards

by **F = ma**, we get:

The **object accelerates** **down** i.e. it **sinks**.



21) The Plate Tectonics Theory

2. principle of buoyancy (floatation)

And now your favorite... an easy table to summarise everything:

Case	Float/sink?	Type?	Density	Forces
1	Floating	partially submerged	Low (less than fluid)	Weight = Upthrust
2		fully submerged	Medium (same as fluid)	
3	Sink	---------------	High (more than fluid)	Weight > Upthrust

21) The Plate Tectonics Theory

3. Pressure equation

This one is easy: $P = F/A$ ($\text{Presure} = \frac{\text{Force}}{\text{Area}}$)

That's all…

21) The Plate Tectonics Theory

4. Pascal's principle

Just remember $P_1 = P_2$:

<u>Pressure is the same (equally transmitted) throughout a fluid</u>

And $P = F/A$

So we have:

$$F_1/A_1 = F_2/A_2$$

21) The Plate Tectonics Theory

5. Bernoulli's principle

2 main things to know:

1. When a fluid flow is restricted, its velocity increases
2. when fluid velocity increases, its pressure decreases

E.g. of 1: Covering a water hose partially with your finger makes the water shoot out faster (higher velocity)

E.g. of 2: hose-end sprayer (see p445), aeroplane lift force due to curved wing

21) The Plate Tectonics Theory

6. Viscosity

Please read carefully your textbook page 446 top…

14.2 Properties of Fluid

1. A stone is thrown into a deep lake. As it sinks deeper and deeper into the water, the buoyant force on it?

A) remains the same.

B) increases.

C) decreases.

D) Not enough information.

(171 Major 2, Q1)

14.2 Properties of Fluid

1. A stone is thrown into a deep lake. As it sinks deeper and deeper into the water, the buoyant force on it?

A) remains the same.

B) increases.

C) decreases.

D) Not enough information.

(171 Major 2, Q1)

14.2 Properties of Fluid

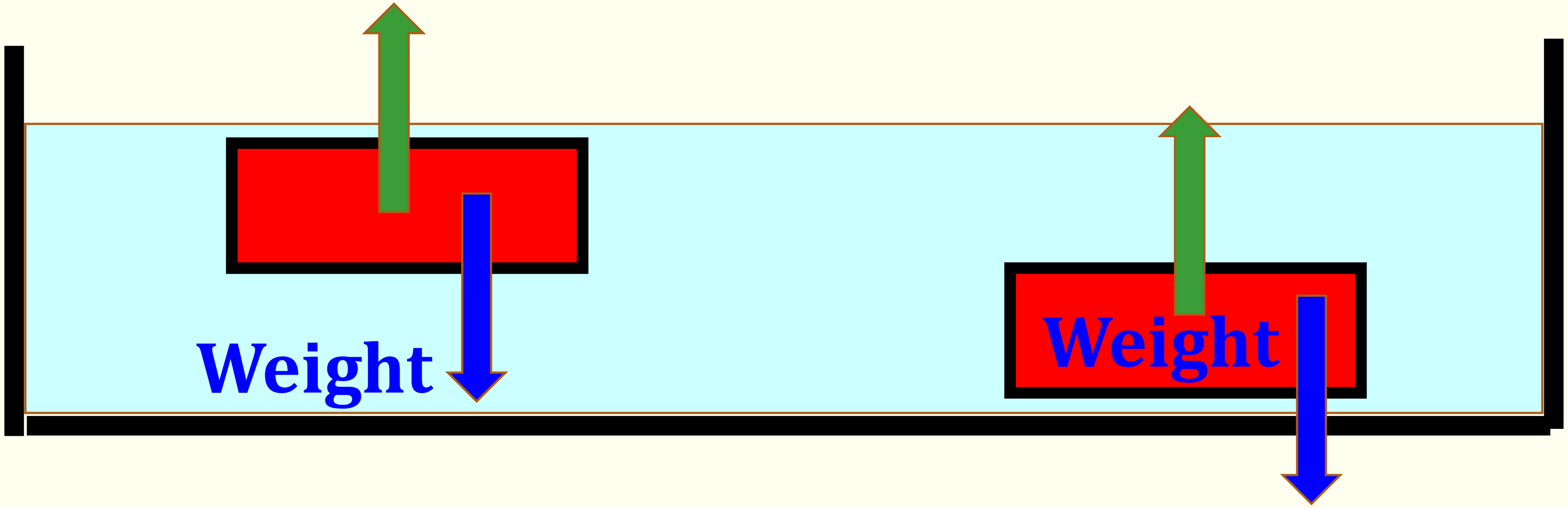
1. Archimedes principle

- very simple. if you put an object in a fluid (liquid/gas), it will have an **up**ward force (called **up**thrust).
- The **amount** of this Force = **weight of fluid displaced**
- It doesn't depend at all on how deep the object is underwater
- Please look at the two objects on the next page

14.2 Properties of Fluid

2. principle of buoyancy (floatation)

Both objects have exactly the same amount of upthrust, which depends on the weight of fluid displaced, so the answer is... (a) remains the same.



14.2 Properties of Fluid

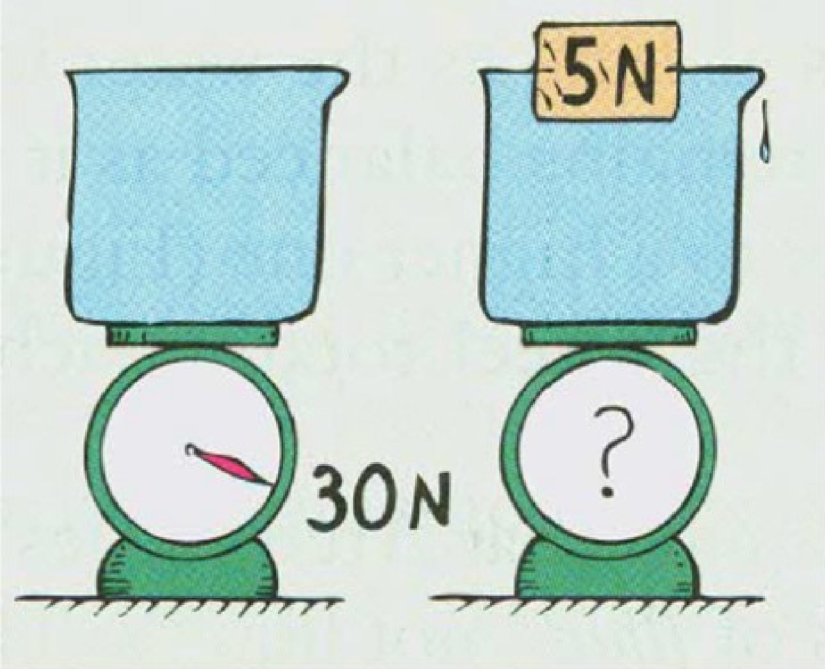
2. A beaker that is completely filled with water weighs 30 N as in the figure below. What would be the reading of the scale when a 5.0 N block of wood floats in it?

A) 25 N

B) 35 N

C) 30 N

D) 40 N



(171 Major 2, Q2)

14.2 Properties of Fluid

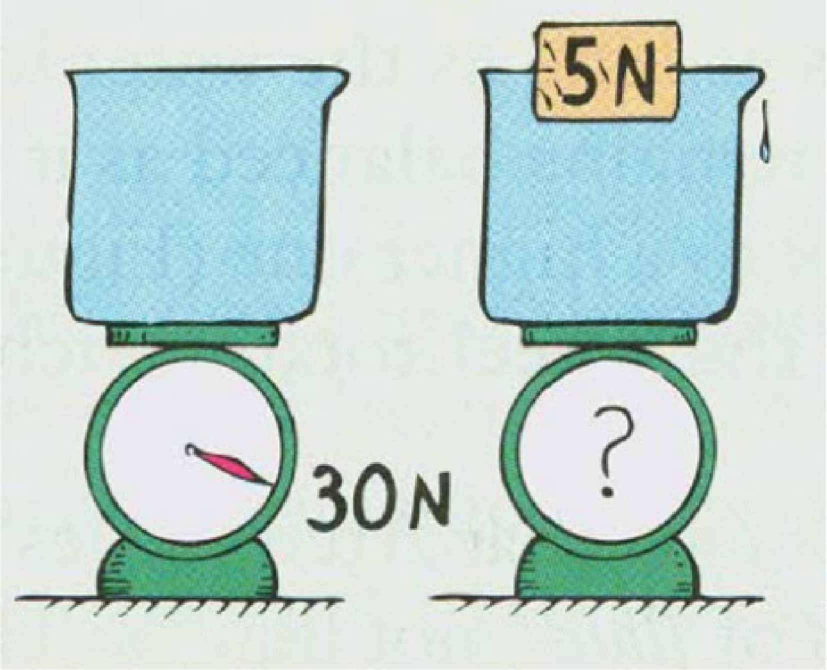
2. A beaker that is completely filled with water weighs 30 N as in the figure below. What would be the reading of the scale when a 5.0 N block of wood floats in it?

A) 25 N

B) 35 N

C) 30 N

D) 40 N



(171 Major 2, Q2)

14.2 Properties of Fluid

- The beaker is completely filled with water

  principle of floating says for a floating object,
  upthrust = weight

- Since the 5 N block is floating, it must have an upthrust on block from water = weight of block

- And Archimedes principle says:

  upthrust = weight of fluid displaced = 5 N

14.2 Properties of Fluid

So 5 N water is displaced and since the beaker is full, the 5 N of water will be splashed out completely.

So, remaining weight

= 30 N (original water)

-5 N (water thrown out)

+5 N (weight of block)

= 30 N

14.2 Properties of Fluid

3. A block suspended by a weighing scale weighs 5.0 N out of water. When it is submerged into water the scale reads its weight as 3.0 N. How much buoyant force acts on the block?

A) 3.0 N

B) 5.0 N

C) 2.0 N

D) 8.0 N

E) None of these.

(171 Final, Q11)

14.2 Properties of Fluid

3. A block suspended by a weighing scale weighs 5.0 N out of water. When it is submerged into water the scale reads its weight as 3.0 N. How much buoyant force acts on the block?

A) 3.0 N

B) 5.0 N

C) 2.0 N

D) 8.0 N

E) None of these.

(171 Final, Q11)

14.2 Properties of Fluid

A block suspended by a weighing scale weighs 5.0 N out of water:

This means real weight in air = 5.0 N

When it is submerged into water the scale reads its weight as 3.0 N:

This means real weight in air (down) – upthrust (up) = 3.0 N (down)

Now, just solve simple equation:

Upthrust = real weight – 3.0 N

= 5.0 N – 3.0 N = 2.0 N

14.2 Properties of Fluid

4. What is the buoyant force on a 0.90 kg of ice floating freely in liquid water?

A) 0.90 N

B) 9.80 N

C) 8.82 N

D) None of these.

(162 Major 2, Q16)

14.2 Properties of Fluid

4. What is the buoyant force on a 0.90 kg of ice floating freely in liquid water?

A) 0.90 N

B) 9.80 N

C) 8.82 N

D) None of these.

(162 Major 2, Q16)

14.2 Properties of Fluid

Remember the principle of buoyancy (floatation)

For either 1. partially or 2. fully submerged: <u>Upthrust = weight</u>

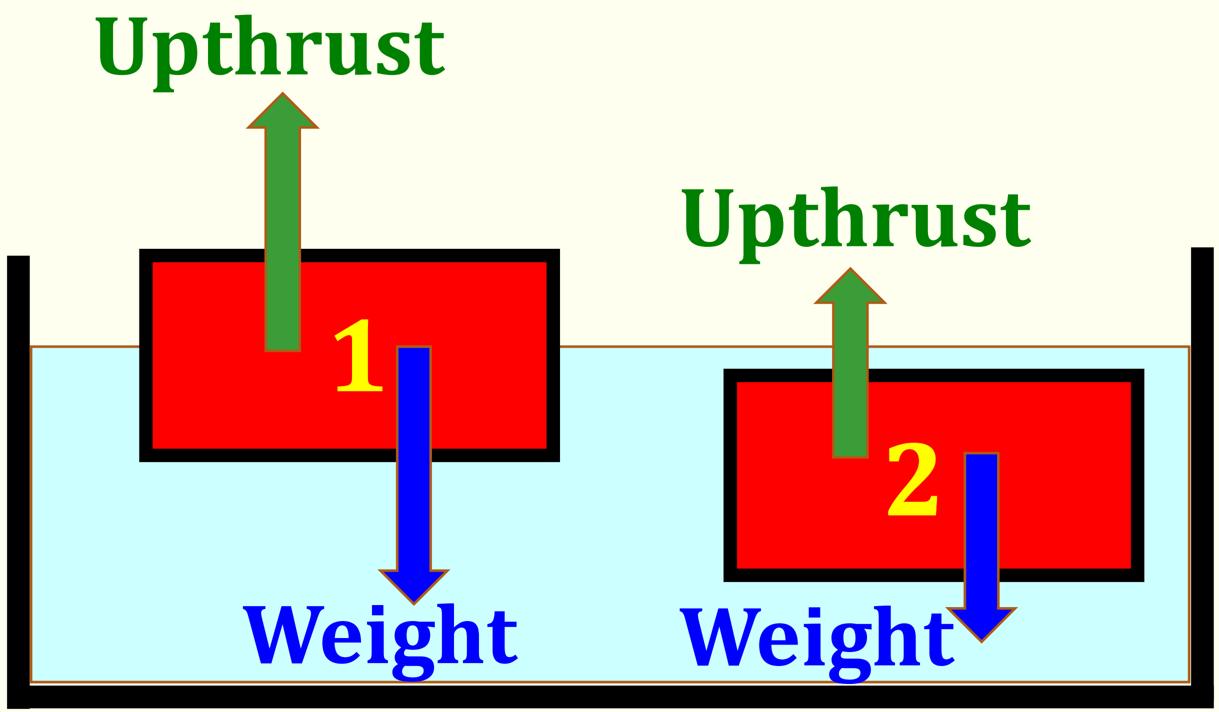
Upthrust force (up) cancels the

Weight/gravitational Force (down)

So Net force = 0

The object doesn't accelerate down

i.e. it floats.



14.2 Properties of Fluid

2. principle of buoyancy (floatation)

The key formula: <u>**Upthrust = weight of object (for floating)**</u>

So, upthrust = buoyant force (both words have same meaning)

= weight of fluid displaced (by Archimedes Principle)

= weight of object (by Principle of Buoyancy)

= 0.9 Kg x 9.8 N/kg

= 8.82 N

14.2 Properties of Fluid

5. If a 0.98-N buoyant force acts on a wooden block while it is submerged in water, what would be the mass of the displaced water?

A) 0.98 kg

B) 9.8 kg

C) 10 kg

D) 0.098 kg

(161 Major 2, Q9)

14.2 Properties of Fluid

5. If a 0.98-N buoyant force acts on a wooden block while it is submerged in water, what would be the mass of the displaced water?

A) 0.98 kg

B) 9.8 kg

C) 10 kg

D) 0.098 kg

(161 Major 2, Q9)

14.2 Properties of Fluid

1. Archimedes principle

The key formula: <u>Upthrust = weight of fluid displaced</u>

So, upthrust = buoyant force (which is 0.98 N in question)

= weight of fluid displaced (by Archimedes Principle)

= 0.98 N

weight of object, use Weight = mass x g-field

$$m = W/g = \frac{0.98\ \text{N}}{10\ \text{N/kg}} = 0.098\ \text{kg}$$

14.2 Properties of Fluid

6. A 100-cm3 block is submerged in water. What is the buoyant force on the block if the density of water is 1.00 g/cm^3?

A) 0.98 N

B) 980 N

C) 100 N

D) 0.10 N

(152 Major 2, Q8)

14.2 Properties of Fluid

6. A 100-cm3 block is submerged in water. What is the buoyant force on the block if the density of water is 1.00 g/cm^3?

A) 0.98 N

B) 980 N

C) 100 N

D) 0.10 N

(152 Major 2, Q8)

14.2 Properties of Fluid

1. Archimedes principle

The key formula: **<u>Upthrust = weight of fluid displaced</u>**

So, upthrust = buoyant force (both words have same meaning)

= weight of fluid displaced (by Archimedes Principle)

= mass of fluid displaced x g-field (W=mg)

= density x volume x g-field (m = density x vol.)

= 1.00 g/cm^3 x 100 cm^3 x 0.001 kg/g x 9.8 N/kg

= 0.98 N

14.2 Properties of Fluid

7. What is the buoyant force acting on a submerged 1.00×10^{-4} m^3 block in water if the density of water is 1000 kg/m^3?

A) 98.0N

B) 0.980 N

C) 100 N

D) 9.80 N

E) Can not be found.

(142 Major 2, Q3)

14.2 Properties of Fluid

7. What is the buoyant force acting on a submerged 1.00×10^{-4} m^3 block in water if the density of water is 1000 kg/m^3?

A) 98.0N

B) 0.980 N

C) 100 N

D) 9.80 N

E) Can not be found.

(142 Major 2, Q3)

14.2 Properties of Fluid

1. Archimedes principle

The key formula: **<u>Upthrust = weight of fluid displaced</u>**

So, upthrust = buoyant force (both words have same meaning)

= weight of fluid displaced (by Archimedes Principle)

= mass of fluid displaced x g-field (W=mg)

= density x volume x g-field (m = density x vol.)

= $1000\ kg/m^3 \times 1.00 \times 10^{-4}\ m^3 \times 9.8\ N/kg$

= 0.980 N

14.2 Properties of Fluid

8. A block of wood is floating in water. The volume of wood under water is 1200 cm^3. What is the buoyant force on the wood?

A) 9.8 N

B) 19.6 N

C) 120 N

D) 11.76 N

(151 Major 2, Q6)

14.2 Properties of Fluid

8. A block of wood is floating in water. The volume of wood under water is 1200 cm^3. What is the buoyant force on the wood?

A) 9.8 N

B) 19.6 N

C) 120 N

D) 11.76 N

(151 Major 2, Q6)

14.2 Properties of Fluid

1. Archimedes principle

The key formula: **<u>Upthrust = weight of fluid displaced</u>**

So, upthrust = buoyant force (both words have same meaning)

= weight of fluid displaced (by Archimedes Principle)

= mass of fluid displaced x g-field (W=mg)

= density x volume x g-field (m = density x vol.)

= 1.00 g/cm^3 x 1200 cm^3 x 0.001 kg/g x 9.8 N/kg

= 11.76 N

14.2 Properties of Fluid

9. When an object is immersed in water, the object will float if

A) the weight of the water displaced is equal to the weight of the object.

B) the weight of the water displaced is equal to the buoyant force.

C) the weight of the water displaced is less than the weight of the object.

D) the density of the object is larger than the density of water.

(152 Final, Q12)

14.2 Properties of Fluid

9. When an object is immersed in water, the object will float if

A) the weight of the water displaced is equal to the weight of the object.

B) the weight of the water displaced is equal to the buoyant force.

C) the weight of the water displaced is less than the weight of the object.

D) the density of the object is larger than the density of water.

(152 Final, Q12)

14.2 Properties of Fluid

This question uses 2 laws:

1. Archimedes principle &

2. principle of buoyancy (floatation)

So, upthrust = weight of fluid displaced (by Archimedes Principle)

= weight of object (by flotation Principle)

So, weight of fluid (i.e. water) displaced = weight of object

14.2 Properties of Fluid

10. Pascal's principle states that

A) as the speed of a fluid increases, the pressure exerted by the fluid decreases.

B) at constant temperature, as the volume of a gas decreases, its pressure increases.

C) pressure applied to a fluid is transmitted throughout the fluid.

D) at constant pressure, the volume of a gas increases with increasing temperature.

(152 Final, Q13)

14.2 Properties of Fluid

10. Pascal's principle states that

A) as the speed of a fluid increases, the pressure exerted by the fluid decreases.

B) at constant temperature, as the volume of a gas decreases, its pressure increases.

C) pressure applied to a fluid is transmitted throughout the fluid.

D) at constant pressure, the volume of a gas increases with increasing temperature.

(152 Final, Q13)

14.2 Properties of Fluid

4. Pascal's principle

Just remember $P_1 = P_2$:

<u>Pressure is the same (equally transmitted) throughout a fluid</u>

So… (c).

14.2 Properties of Fluid

11. A diver who is 10.0 m underwater experiences a pressure of 202 kPa. If the diver's surface area is 1.50 m^2, with how much total force does the water push on the diver?

A) 303 N

B) 303,000 N

C) 3,030,000 N

D) 135,000 N

(152 Final, Q14)

14.2 Properties of Fluid

11. A diver who is 10.0 m underwater experiences a pressure of 202 kPa. If the diver's surface area is 1.50 m^2, with how much total force does the water push on the diver?

A) 303 N

B) 303,000 N

C) 3,030,000 N

D) 135,000 N

(152 Final, Q14)

14.2 Properties of Fluid

3. Pressure equation

This one is easy: P = F/A (Presure = $\frac{\text{Force}}{\text{Area}}$)

So F = P x A = 202 kPa x 1.5 m^2

= 202 000 Pa x 1.5 m^2 (convert kPa to Pa – x 1000)

= 202 000 N/m^2 x 1.5 m^2 (convert Pa to N/m^2)

= 303 000 N

14.2 Properties of Fluid

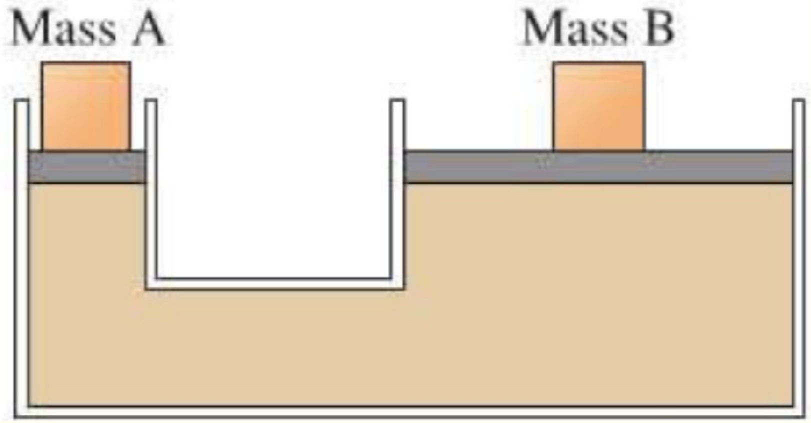
12. Masses A and B rest on very light pistons that enclose a fluid, as shown in the figure below. There is no friction between the pistons and the cylinders they fit inside. Which of the following is true?

A) Mass B is the same as Mass A.

B) Mass B is greater than Mass A.

C) Mass B is smaller than Mass A.

D) Not enough information.



(171 Major 2, Q6)

14.2 Properties of Fluid

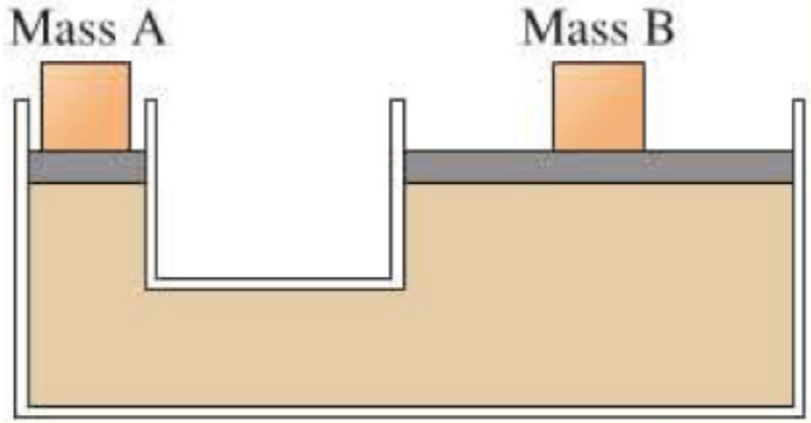
12. Masses A and B rest on very light pistons that enclose a fluid, as shown in the figure below. There is no friction between the pistons and the cylinders they fit inside. Which of the following is true?

A) Mass B is the same as Mass A.

B) Mass B is greater than Mass A.

C) Mass B is smaller than Mass A.

D) Not enough information.



(171 Major 2, Q6)

14.2 Properties of Fluid

4. Pascal's principle

Just remember
$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

By cross-multiplying,
$$\frac{F_1}{F_2} = \frac{A_1}{A_2}$$

Let’s call it A & B (not 1 & 2) , as mentioned in the question:

$$\frac{F_A}{F_B} = \frac{A_A}{A_B}$$

14.2 Properties of Fluid

4. Pascal's principle

$$\frac{F_A}{F_B} = \frac{A_A}{A_B}$$

Using F = W = mg, we get:

$$\frac{m_A g}{m_B g} = \frac{A_A}{A_B}$$

$$\frac{m_A}{m_B} = \frac{A_A}{A_B}$$

14.2 Properties of Fluid

4. Pascal's principle

$$\frac{m_A}{m_B} = \frac{A_A}{A_B}$$

Now it's easy... Since $A_b > A_A$,

we must have $m_b > m_A$.

14.2 Properties of Fluid

13. A hydraulic lift is used to lift a heavy box that is pushing down on a 5.0-m^2 piston with a force of 2,000 N. What force needs to be exerted on a 0.05-m^2 piston to lift the box?

A) 200,000 N

B) 2,000 N

C) 20 N

D) 500 N

(161 Major 2, Q10)

14.2 Properties of Fluid

13. A hydraulic lift is used to lift a heavy box that is pushing down on a 5.0-m^2 piston with a force of 2,000 N. What force needs to be exerted on a 0.05-m^2 piston to lift the box?

A) 200,000 N

B) 2,000 N

C) 20 N

D) 500 N

(161 Major 2, Q10)

14.2 Properties of Fluid

4. Pascal's principle

Same old equation:

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

From question, $F_1 = 2000\ N$, $A_1 = 5.0\ m^2$

$F_2 = ???\ N$, $A_2 = 0.05\ m^2$

Now, just substitute these numbers into above equation.

14.2 Properties of Fluid

4. Pascal's principle

Same old equation:

$$\frac{2000}{5.0} = \frac{F_2}{0.05}$$

$$F_2 = \frac{2000}{5.0} \times 0.05 = 20\ N$$

14.2 Properties of Fluid

14. A hydraulic lift is used to lift a heavy machine that is pushing down on a 3.0 m^2 platform with a force of 4,000 N. What force must be exerted on a 0.08-m^2 piston to lift the heavy machine?

A) 150,000N

B) 1,333 N

C) 107 N

D) 0.027 N

E) 50,000 N

(142 Major 2, Q4)

14.2 Properties of Fluid

14. A hydraulic lift is used to lift a heavy machine that is pushing down on a 3.0 m^2 platform with a force of 4,000 N. What force must be exerted on a 0.08-m^2 piston to lift the heavy machine?

A) 150,000N

B) 1,333 N

C) 107 N

D) 0.027 N

E) 50,000 N

(142 Major 2, Q4)

14.2 Properties of Fluid

4. Pascal's principle

Same old equation:

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

From question, $F_1 = 4000$ N, $A_1 = 3.0$ m^2

$F_2 = ???$ N, $A_2 = 0.08$ m^2

Now, just substitute these numbers into above equation.

14.2 Properties of Fluid

4. Pascal's principle

$$\frac{4000}{3.0} = \frac{F_2}{0.08}$$

$$F_2 = \frac{4000}{3.0} \times 0.08 = 106.67\ \text{N} \approx 107\ \text{N}$$

14.2 Properties of Fluid

15. If a pressure of 20 kPa is applied to one piston in a simple hydraulic device, the pressure on a piston of larger area will be

A) less than 20 kPa.

B) more than 20 kPa

C) the same 20 kPa.

D) Not enough information.

(162 Major 2, Q18)

14.2 Properties of Fluid

15. If a pressure of 20 kPa is applied to one piston in a simple hydraulic device, the pressure on a piston of larger area will be

A) less than 20 kPa.

B) more than 20 kPa

C) the same 20 kPa.

D) Not enough information.

(162 Major 2, Q18)

14.2 Properties of Fluid

4. Pascal's principle

Just remember $P_1 = P_2$:

Pressure is the same (equally transmitted) throughout a fluid

So… (c).

14.2 Properties of Fluid

16. A car on a 25-m^2 hydraulic lift platform weighs 15,000 N. If the force on the smaller piston required to lift the car is 1/100 its weight, what is the area of the smaller piston?

A) 4.0 m^2

B) 25 m^2

C) 0.25 m^2

D) 2500 m^2

(152 Major 2, Q9)

14.2 Properties of Fluid

16. A car on a 25-m^2 hydraulic lift platform weighs 15,000 N. If the force on the smaller piston required to lift the car is 1/100 its weight, what is the area of the smaller piston?

A) 4.0 m^2

B) 25 m^2

C) 0.25 m^2

D) 2500 m^2

(152 Major 2, Q9)

14.2 Properties of Fluid

4. Pascal's principle

Same old equation:

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

From question, $F_1 = 15000$ N, $A_1 = 25.0\ m^2$

$F_2 = 15000\ N \times \frac{1}{100} = 150$ N, $A_2 = ???\ m^2$

Now, just substitute these numbers into above equation.

14.2 Properties of Fluid

4. Pascal's principle

$$\frac{15000}{25.0} = \frac{150}{A_2}$$

$$A_2 = \frac{150}{15000} \times 25 = 0.25\ m^2$$

14.2 Properties of Fluid

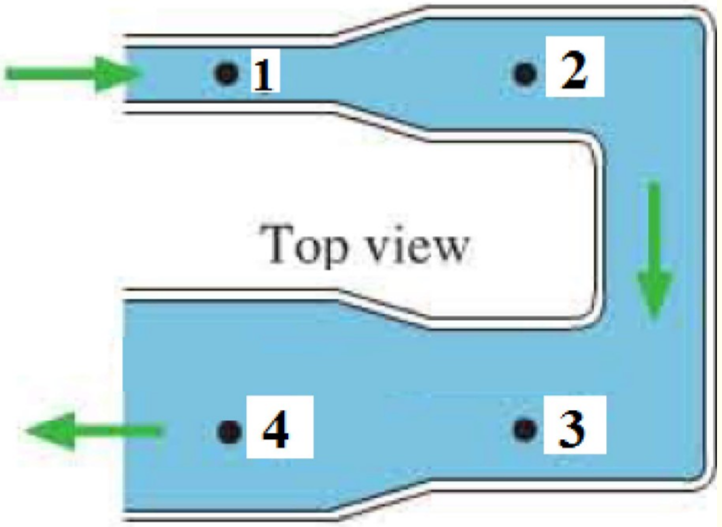
17. A liquid with negligible viscosity flows through the pipe shown in the figure below. This is an overhead view. At what point the pressure of the liquid is highest?

A) At point number 1.

B) At point number 2.

C) At point number 3.

D) At point number 4.



(171 Major 2, Q5)

14.2 Properties of Fluid

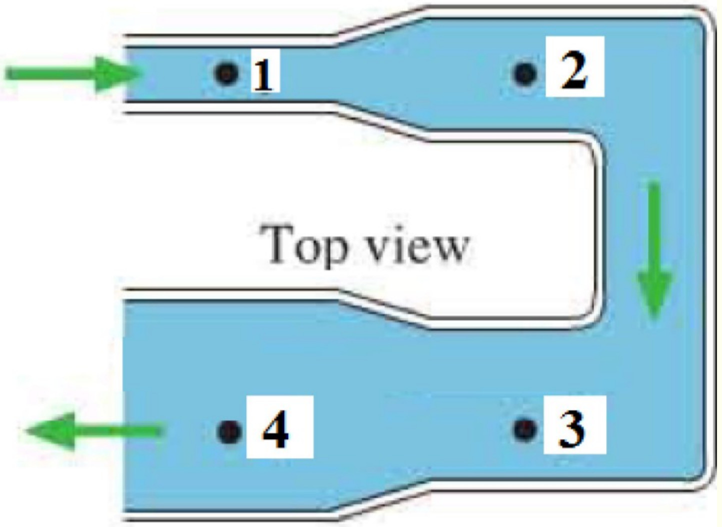
17. A liquid with negligible viscosity flows through the pipe shown in the figure below. This is an overhead view. At what point the pressure of the liquid is highest?

A) At point number 1.

B) At point number 2.

C) At point number 3.

D) At point number 4.



(171 Major 2, Q5)

14.2 Properties of Fluid

5. Bernoulli's principle

The relevant info is:

1. **When a fluid flow is restricted (area reduced), its velocity increases:**

This means: **smallest area = highest velocity**

2. **when fluid velocity increases, its pressure decreases**

This means: **smallest pressure = highest velocity**

Combining these 2 laws, we get:

smallest pressure = highest velocity = smallest area

14.2 Properties of Fluid

5. Bernoulli's principle

smallest pressure = highest velocity = smallest area

So smallest pressure = smallest area

Thus, largest pressure = largest area

Point 4 has the largest area and thus the largest pressure.

14.2 Properties of Fluid

18. When the flow of a fluid is restricted,

A) its speed decreases and its pressure increases.

B) its speed increases and its pressure decreases.

C) both the speed and the pressure of the fluid increase.

D) its speed increases but its pressure remains unchanged.

(152 Major 2, Q10)

14.2 Properties of Fluid

18. When the flow of a fluid is restricted,

A) its speed decreases and its pressure increases.

B) its speed increases and its pressure decreases.

C) both the speed and the pressure of the fluid increase.

D) its speed increases but its pressure remains unchanged.

(152 Major 2, Q10)

14.2 Properties of Fluid

5. Bernoulli's principle

The relevant info is:

1. **When a fluid flow is restricted (area reduced), its velocity increases:**

This means: **smallest area = highest velocity**

2. **when fluid velocity increases, its pressure decreases**

This means: **smallest pressure = highest velocity**

Combining these 2 laws, we get:

smallest pressure = highest velocity = smallest area

14.2 Properties of Fluid

5. Bernoulli's principle

smallest pressure = highest velocity = smallest area

So ... (b) is correct: its speed increases (highest velocity) and its pressure decreases (smallest pressure)

14.2 Properties of Fluid

19. When the flow of a fluid is restricted,

A) its velocity decreases and its pressure increases.

B) its velocity increases and its pressure decreases.

C) its velocity increases and its pressure increases.

D) its velocity decreases but its pressure remains unchanged.

E) its velocity and its pressure remain unchanged.

(142 Major 2, Q5)

14.2 Properties of Fluid

19. When the flow of a fluid is restricted,

A) its velocity decreases and its pressure increases.

B) its velocity increases and its pressure decreases.

C) its velocity increases and its pressure increases.

D) its velocity decreases but its pressure remains unchanged.

E) its velocity and its pressure remain unchanged.

(142 Major 2, Q5)

14.2 Properties of Fluid

5. Bernoulli's principle

The relevant info is:

1. **When a fluid flow is restricted (area reduced), its velocity increases:**

This means: **smallest area = highest velocity**

2. **when fluid velocity increases, its pressure decreases**

This means: **smallest pressure = highest velocity**

Combining these 2 laws, we get:

smallest pressure = highest velocity = smallest area

14.2 Properties of Fluid

5. Bernoulli's principle

smallest pressure = highest velocity = smallest area

So ... (b) is correct: its speed increases (highest velocity) and its pressure decreases (smallest pressure)

14.2 Properties of Fluid

20. Which uses Bernoulli's principle?

A) Hose-end sprayer

B) Piston

C) Skateboard

D) Buoyancy

(151 Final, Q8)

14.2 Properties of Fluid

20. Which uses Bernoulli's principle?

A) Hose-end sprayer

B) Piston

C) Skateboard

D) Buoyancy

(151 Final, Q8)

14.2 Properties of Fluid

5. Bernoulli's principle

2 main things to know:

1. **When a fluid flow is restricted, its velocity increases**
2. **when fluid velocity increases, its pressure decreases**

E.g. of 1: Covering a water hose partially with your finger makes the water shoot out faster (higher velocity)

E.g. of 2: <u>hose-end sprayer</u> (see p445), aeroplane lift force due to curved wing

14.2 Properties of Fluid

21. An umbrella tends to move upwards in a windy day principally because

A) buoyancy increases with increasing wind speed.

B) air pressure is reduced over the curved top surface.

C) air gets trapped under the umbrella, warms, and rises.

D) None of these.

(171 Major 2, Q3)

14.2 Properties of Fluid

21. An umbrella tends to move upwards in a windy day principally because

A) buoyancy increases with increasing wind speed.

B) air pressure is reduced over the curved top surface.

C) air gets trapped under the umbrella, warms, and rises.

D) None of these.

(171 Major 2, Q3)

14.2 Properties of Fluid

5. Bernoulli's principle

The relevant info is:

2. when fluid velocity increases, its pressure decreases

This means: smallest pressure = highest velocity

Wind blowing = higher velocity = smaller pressure

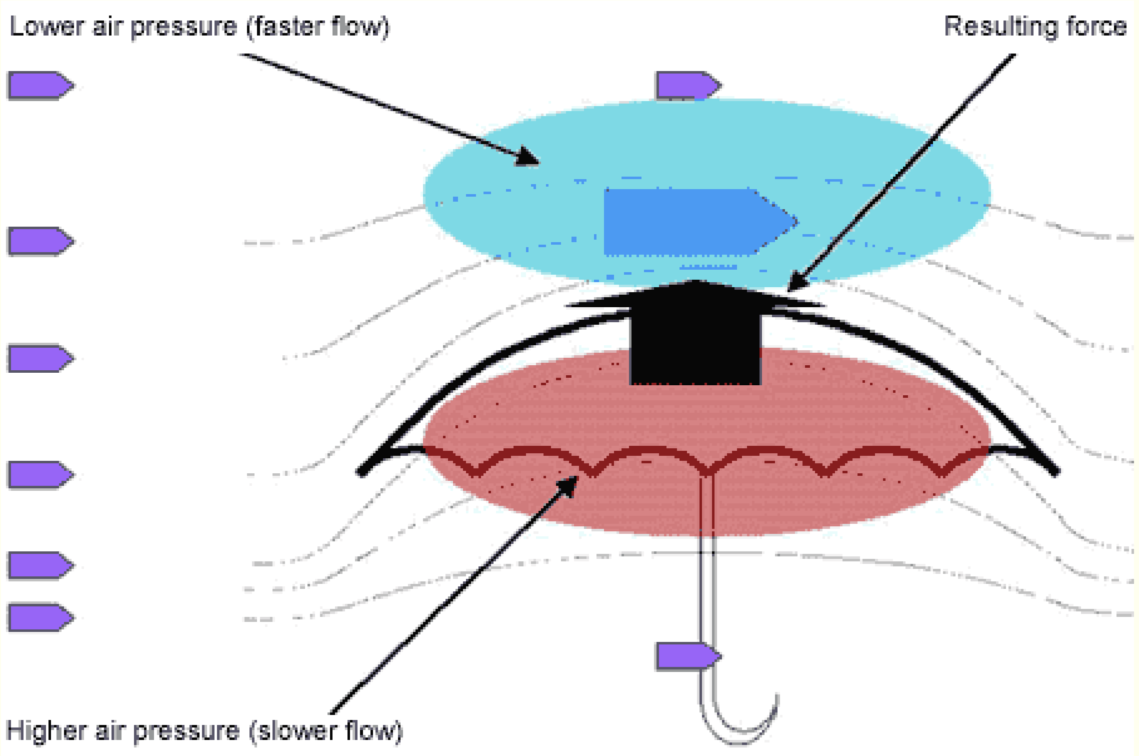
The wind above the umbrella is blowing faster (low pressure) than wind below umbrella (high pressure)

Net force is from high pressure region (below umbrella) to low pressure region (above umbrella) i.e. the net force on umbrella is upwards

14.2 Properties of Fluid

5. Bernoulli's principle

This figure will make clear the ideas on previous page:



14.2 Properties of Fluid

22. On a windy day, atmospheric pressure

A) increases.

B) remains unchanged.

C) Not enough information.

D) decreases.

(162 Major 2, Q17)

14.2 Properties of Fluid

22. On a windy day, atmospheric pressure

A) increases.

B) remains unchanged.

C) Not enough information.

D) decreases.

(162 Major 2, Q17)

14.2 Properties of Fluid

5. Bernoulli's principle

The relevant info is:

2. **when fluid velocity increases, its pressure decreases**

This means: **smallest pressure = highest velocity**

Wind blowing = higher velocity = smaller pressure

14.2 Properties of Fluid

23. Wind blowing over the roof of a building

A) doesn’t affect atmospheric pressure there.

B) Increases the gravitational force there.

C) decreases atmospheric pressure there.

D) increases atmospheric pressure there.

(151 Major 2, Q7)

14.2 Properties of Fluid

23. Wind blowing over the roof of a building

A) doesn’t affect atmospheric pressure there.

B) Increases the gravitational force there.

C) decreases atmospheric pressure there.

D) increases atmospheric pressure there.

(151 Major 2, Q7)

14.2 Properties of Fluid

5. Bernoulli's principle

The relevant info is:

2. when fluid velocity increases, its pressure decreases

This means: **smallest pressure = highest velocity**

Wind blowing = higher velocity = smaller pressure

14.3 Behavior of Gases

14.3 Behavior of Gases

Very Important Equations For This Chapter

$P \propto \frac{1}{V}$ $\left(\text{Pressure} \propto \frac{1}{\text{volume}}\right)$ → Boyle's Law

$V \propto T$ (volume ∝ temperature) → Charles' Law

$PV \propto T$ (Pressure x volume ∝ temperature) → Ideal Gas Law

From Ideal Gas Law, You can get both Boyle's and Charles' law

$PV \propto T$ → For constant T, $PV \propto \cancel{T}$ → $PV \propto 1$ → $P \propto \frac{1}{V}$ → Boyle's Law

$PV \propto T$ → For constant P, $\cancel{P}V \propto T$ → $V \propto T$ → Charles' Law

14.3 Behavior of Gases

Very Important Equations For This Chapter

$$\mathbf{d} = \frac{M}{V} \qquad \left(\text{density} = \frac{mass}{\text{volume}}\right)$$

$$\mathbf{d} \propto \frac{1}{V} \qquad \left(\text{density} \propto \frac{1}{\text{volume}}\right)$$

This d $\propto \frac{1}{V}$ applies for constant mass only.

14.3 Behavior of Gases

1. A balloon is launched at sea level. where the air pressure is 100 kPa. The density in the hot-air chamber is 1.0 kg/m^3. What is the density of the air when the balloon has risen to a height where the atmospheric pressure is 33 kPa?

A) 3.03 kg/m^3

B) 1.00 kg/m^3

C) 0.33 kg/m^3

D) 0.66 kg/m^3

(171 Major 2, Q8)

14.3 Behavior of Gases

1. A balloon is launched at sea level. where the air pressure is 100 kPa. The density in the hot-air chamber is 1.0 kg/m^3. What is the density of the air when the balloon has risen to a height where the atmospheric pressure is 33 kPa?

A) 3.03 kg/m^3

B) 1.00 kg/m^3

C) 0.33 kg/m^3

D) 0.66 kg/m^3

(171 Major 2, Q8)

14.3 Behavior of Gases

$P_1 = 100$ kPa. $d_1 = 1.0$ kg/m^3.

$P_2 = 33$ kPa. $d_2 = ??$ kg/m^3.

$$P \propto \frac{1}{V} \qquad V \propto T \qquad d \propto \frac{1}{V}$$

Since the question involves P and d, the relevant equation is: $P \propto d$

$$\frac{P_1}{d_1} = \frac{P_2}{d_2}$$

$$\frac{100}{1.0} = \frac{33}{d_2}$$

$d_2 = 0.33$ kg/m^3

14.3 Behavior of Gases

2. A 5.00-liter rubber balloon is submerged 5 meters under ocean water where its new volume is measured to be 3.38 liters. What is the pressure at this depth if the pressure at sea level is 1.00 atm (atmospheric pressure)? (assume that the temperature is constant)

A) 0.68 atm

B) 1.00 atm

C) 7.40 atm

D) 1.48 atm

E) 3.00 atm

(171 Final, Q12)

14.3 Behavior of Gases

2. A 5.00-liter rubber balloon is submerged 5 meters under ocean water where its new volume is measured to be 3.38 liters. What is the pressure at this depth if the pressure at sea level is 1.00 atm (atmospheric pressure)? (assume that the temperature is constant)

A) 0.68 atm

B) 1.00 atm

C) 7.40 atm

D) 1.48 atm

E) 3.00 atm

(171 Final, Q12)

14.3 Behavior of Gases

P_1 = 1 atm. V_1 = 5 L.

P_2 = ?? atm. V_2 = 3.38 L.

$$P \propto \frac{1}{V} \qquad V \propto T \qquad d \propto \frac{1}{V}$$

Since the question involves P and V, the relevant equation is: $P \propto \frac{1}{V}$

$$P_1V_1 = P_2V_2$$

$1 \times 5 = P_2 \times 3.38$

$P_2 = 5/3.38$ atm = 1.48 atm

14.3 Behavior of Gases

3. The volume of air in a person's lungs is 615 mL at a pressure of 760 mmHg. Inhalation occurs as the pressure in the lungs drops to 752 mmHg with no change in temperature and amount of gas. To what volume, in milliliters (mL), did the lungs expand? (Note: 760 mmHg=101.325 kPa)

A) 609 mL.

B) 622 mL.

C) 702 mL.

D) 900 mL.

(162 Major 2, Q20)

14.3 Behavior of Gases

3. The volume of air in a person's lungs is 615 mL at a pressure of 760 mmHg. Inhalation occurs as the pressure in the lungs drops to 752 mmHg with no change in temperature and amount of gas. To what volume, in milliliters (mL), did the lungs expand? (Note: 760 mmHg=101.325 kPa)

A) 609 mL.

B) 622 mL.

C) 702 mL.

D) 900 mL.

(162 Major 2, Q20)

14.3 Behavior of Gases

P_1 = 760 mmHg. V_1 = 615 mL.

P_2 = 752 mmHg. V_2 = ?? mL.

$$P \propto \frac{1}{V} \qquad V \propto T \qquad d \propto \frac{1}{V}$$

Since the question involves P and V, the relevant equation is: $P \propto \frac{1}{V}$

$$P_1V_1 = P_2V_2$$

$760 \text{ x } 615 = 752 \text{ x } V_2$

$V_2 = 760 \text{ x } 615/752 = 621.5 \text{ mL} \approx 622 \text{ mL}$

14.3 Behavior of Gases

4. A weather balloon has a volume of 90.0 L when it is released from sea level, where the pressure is 101 kPa. What is the atmospheric pressure on the balloon when it has grown to a size of 200 L? (Assume the temperature is constant)

A) 50.5 kPa

B) 224 kPa

C) 101 kPa

D) 45.5 kPa

(152 Major 2, Q12)

14.3 Behavior of Gases

4. A weather balloon has a volume of 90.0 L when it is released from sea level, where the pressure is 101 kPa. What is the atmospheric pressure on the balloon when it has grown to a size of 200 L? (Assume the temperature is constant)

A) 50.5 kPa

B) 224 kPa

C) 101 kPa

D) 45.5 kPa

(152 Major 2, Q12)

14.3 Behavior of Gases

P_1 = 101 kPa. V_1 = 90 L.

P_2 = ?? atm. V_2 = 200 L.

$P \propto \frac{1}{V}$ $V \propto T$ $d \propto \frac{1}{V}$

Since the question involves P and V, the relevant equation is: $P \propto \frac{1}{V}$

$$P_1V_1 = P_2V_2$$

$101 \times 90 = P_2 \times 200$

P_2 = 101 x 90/200 atm = 45.45 kPa

14.3 Behavior of Gases

5. A balloon has a volume of 5 L at 101 kPa atmospheric pressure. if the balloon is placed in a box where the pressure is reduced by one-half and the temperature is held constant, the volume of the balloon will

A) be decreased to 2.5 L.

B) be increased to 7.5 L.

C) be increased to 10 L.

D) remain unchanged.

(151 Major 2, Q8)

14.3 Behavior of Gases

5. A balloon has a volume of 5 L at 101 kPa atmospheric pressure. if the balloon is placed in a box where the pressure is reduced by one-half and the temperature is held constant, the volume of the balloon will

A) be decreased to 2.5 L.

B) be increased to 7.5 L.

C) be increased to 10 L.

D) remain unchanged.

(151 Major 2, Q8)

14.3 Behavior of Gases

P_1 = 101 kPa. V_1 = 5 L.

P_2 = 0.5 x 101 kPa = 50.5 kPa. V_2 = ?? L.

$$P \propto \frac{1}{V} \qquad V \propto T \qquad d \propto \frac{1}{V}$$

Since the question involves P and V, the relevant equation is: $P \propto \frac{1}{V}$

$$P_1V_1 = P_2V_2$$

101 x 5 = 50.5 x V_2

V_2 = 101 x 5/50.5 = 10 L

14.3 Behavior of Gases

6. A weather balloon has a volume of 100 L when it is released from sea level, where the pressure is 101 kPa. What is the atmospheric pressure on the balloon when it has grown to a size of 190 L?

A) 0.532 kPa

B) 10,100 kPa

C) 192 kPa

D) 53.2 kPa

E) 1.90 kPa

(142 Major 2, Q6)

14.3 Behavior of Gases

6. A weather balloon has a volume of 100 L when it is released from sea level, where the pressure is 101 kPa. What is the atmospheric pressure on the balloon when it has grown to a size of 190 L?

A) 0.532 kPa

B) 10,100 kPa

C) 192 kPa

D) 53.2 kPa

E) 1.90 kPa

(142 Major 2, Q6)

14.3 Behavior of Gases

P_1 = 101 kPa. V_1 = 100 L.

P_2 = ?? kPa. V_2 = 190 L.

$$P \propto \frac{1}{V} \qquad V \propto T \qquad d \propto \frac{1}{V}$$

Since the question involves P and V, the relevant equation is: $P \propto \frac{1}{V}$

$$P_1V_1 = P_2V_2$$

101 x 100 = P_2 x 190

P_2 = 101 x 100/190 = 53.15 kPa ≈ 53.2 kPa

14.3 Behavior of Gases

7. To what temperature must a gas sample initially at 0ºC be heated if its volume is to double while its pressure remains the same?

A) 546ºC

B) 273ºC

C) 0ºC

D) -136.5ºC

(171 Major 2, Q4)

14.3 Behavior of Gases

7. To what temperature must a gas sample initially at 0ºC be heated if its volume is to double while its pressure remains the same?

A) 546ºC

B) 273ºC

C) 0ºC

D) -136.5ºC

(171 Major 2, Q4)

14.3 Behavior of Gases

T_1 = 0 °C = 273 K. V_1 = V.

T_2 = ?? K. V_2 = 2V.

$$P \propto \frac{1}{V} \qquad V \propto T \qquad d \propto \frac{1}{V}$$

Since the question involves T and V, the relevant equation is: $V \propto T$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{V}{273} = \frac{2V}{T_2}$$

P_2 = 273 x 2V/V = 546 K = 273 ºC

14.3 Behavior of Gases

8. To what Celsius temperature must a gas sample initially at -20ºC be heated if its volume is to double while its pressure remains the same?

A) 253 ºC

B) 506 ºC

C) 40 ºC

D) 233 ºC

(162 Major 2, Q15)

14.3 Behavior of Gases

8. To what Celsius temperature must a gas sample initially at -20ºC be heated if its volume is to double while its pressure remains the same?

A) 253 ºC

B) 506 ºC

C) 40 ºC

D) 233 ºC

(162 Major 2, Q15)

14.3 Behavior of Gases

T_1 = -20 °C = 253 K. V_1 = V.

T_2 = ?? K. V_2 = 2V.

$$P \propto \frac{1}{V} \qquad V \propto T \qquad d \propto \frac{1}{V}$$

Since the question involves T and V, the relevant equation is: $V \propto T$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{V}{253} = \frac{2V}{T_2}$$

P_2 = 253 x 2V/V = 506 K = 233 ºC

14.3 Behavior of Gases

9. To what Celsius temperature must a gas sample (initially at 20ºC) be heated if its volume to double while its pressure remains constant?

A) 40ºC

B) 273ºC

C) 586ºC

D) 313ºC

(161 Major 2, Q8)

14.3 Behavior of Gases

9. To what Celsius temperature must a gas sample (initially at 20ºC) be heated if its volume to double while its pressure remains constant?

A) 40ºC

B) 273ºC

C) 586ºC

D) 313ºC

(161 Major 2, Q8)

14.3 Behavior of Gases

T_1 = 20 °C = 293 K. V_1 = V.

T_2 = ?? K. V_2 = 2V.

$$P \propto \frac{1}{V} \qquad V \propto T \qquad d \propto \frac{1}{V}$$

Since the question involves T and V, the relevant equation is: $V \propto T$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{V}{293} = \frac{2V}{T_2}$$

P_2 = 293 x 2V/V = 586 K = 313 ºC

14.3 Behavior of Gases

10. A 2.0-L balloon at room temperature (20.0ºC) is placed in a freezer at -10.0ºC. What is the volume of the balloon after it cools in the freezer? (Assume the pressure is constant)

A) 2.0 L

B) 2.2 L

C) -1.0 L

D) 1.8 L

(152 Major 2, Q11)

14.3 Behavior of Gases

10. A 2.0-L balloon at room temperature (20.0ºC) is placed in a freezer at -10.0ºC. What is the volume of the balloon after it cools in the freezer? (Assume the pressure is constant)

A) 2.0 L

B) 2.2 L

C) -1.0 L

D) 1.8 L

(152 Major 2, Q11)

14.3 Behavior of Gases

T_1 = 20 °C = 293 K.

V_1 = 2.0 L

T_2 = -10 °C = 263 K

V_2 = ??? L

$$P \propto \frac{1}{V} \qquad V \propto T \qquad d \propto \frac{1}{V}$$

Since the question involves T and V, the relevant equation is: $V \propto T$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{2.0}{293} = \frac{V_2}{263}$$

V_2 = 263 x 2/293 = 1.795 L ≈ 1.8 L

14.3 Behavior of Gases

11. As the temperature of a gas increases from 0ºC to 273ºC at constant pressure, the volume of the gas

A) decreases by one-half.

B) doubles.

C) remains constant.

D) decreases to zero.

(151 Major 2, Q9)

14.3 Behavior of Gases

11. As the temperature of a gas increases from 0ºC to 273ºC at constant pressure, the volume of the gas

A) decreases by one-half.

B) doubles.

C) remains constant.

D) decreases to zero.

(151 Major 2, Q9)

14.3 Behavior of Gases

T_1 = 0 °C = 273 K. V_1 = V.

T_2 = 273 °C = 546 K. V_2 = ???

$$P \propto \frac{1}{V} \qquad V \propto T \qquad d \propto \frac{1}{V}$$

Since the question involves T and V, the relevant equation is: $V \propto T$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{V}{273} = \frac{V_2}{546}$$

V_2 = V x 546/273 = 2V;

V_2/V_1 = 2V/V = 2 (i.e. doubles)

14.3 Behavior of Gases

12. A 4.0-L balloon at room temperature (20ºC) is placed in a freezer at -20ºC. What is the volume of the balloon after it cools down in the freezer?

A) -4.0 L

B) 0.86 L

C) 0.01 L

D) 3.5 L

E) 4.6 L

(142 Major 2, Q7)

14.3 Behavior of Gases

12. A 4.0-L balloon at room temperature (20ºC) is placed in a freezer at -20ºC. What is the volume of the balloon after it cools down in the freezer?

A) -4.0 L

B) 0.86 L

C) 0.01 L

D) 3.5 L

E) 4.6 L

(142 Major 2, Q7)

14.3 Behavior of Gases

T_1 = 20 °C = 293 K. V_1 = 2.0 L

T_2 = -20 °C = 253 K V_2 = ??? L

$$P \propto \frac{1}{V} \qquad V \propto T \qquad d \propto \frac{1}{V}$$

Since the question involves T and V, the relevant equation is: $V \propto T$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

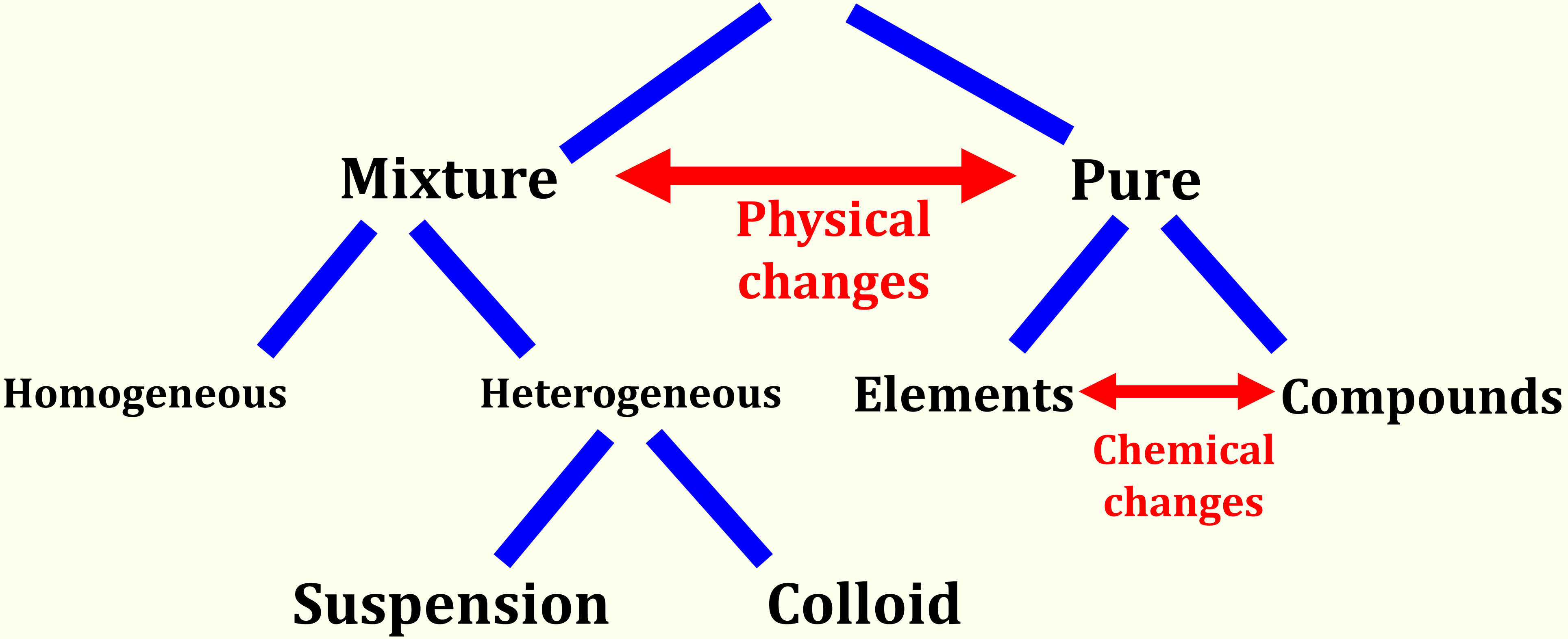
$$\frac{4.0}{293} = \frac{V_2}{253}$$

V_2 = 253 x 4/293 = 3.453 L ≈ 3.5 L

15.1 Composition of Matter

15.1 Composition of Matter

- All matter/substances can be classified as follows (p468):



15.1 Composition of Matter

- Now we will study the properties of these substances in the next 3 slides.
- memorise these properties very well because they will be repeatedly used to solve the questions

15.1 Composition of Matter

Name	Properties
Elements	• Anything made from all similar atoms • Basically all the things you see in periodic table • Cannot be broken down by chemical methods
Compounds	• Combination of 2 or more elements chemically bonded together • Cannot be separated into its elements by physical methods • Has different properties from its constituent elements
Pure	• Any Elements or Compounds

15.1 Composition of Matter

Name	Properties
Mixture	• Made of 2 or more substances that can be separated by physical methods
Substance	• Any Pure Substance or Mixture
Homogeneous mixture	• Mixture that remains constantly & uniform mixed • Particles never settle • particles cannot be seen with microscope
Heterogeneous mixture	• A mixture where different materials remain distinct • Normally particles can be seen with microscope

15.1 Composition of Matter

Name	Properties
Suspension	• Heterogeneous mixture of solid and liquid particles • Particles **will finally settle**
Colloid	• Particles **never settle** • **Light beam** is **visible** due to scattering when passing through colloid (**Tyndall** effect)

- **Now that you have memorized all these properties and understood them properly, you can answer the following questions easily**
- **If you forget don't worry, just come back & revise again and again**

15.1 Composition of Matter

1. A pure substance that cannot be decomposed by chemical means is called ____________.

A) a solution.

B) an element.

C) a compound.

D) a colloid.

(171 Major 2, Q9)

15.1 Composition of Matter

1. A pure substance that cannot be decomposed by chemical means is called ____________.

A) a solution.

B) an element.

C) a compound.

D) a colloid.

(171 Major 2, Q9)

15.1 Composition of Matter

Name	Properties
Elements	• Anything made from all similar atoms • Basically all the things you see in periodic table • **<u>Cannot be broken down by chemical methods</u>**
Compounds	• Combination of 2 or more elements chemically bonded together • Cannot be separated into its elements by physical methods • Has different properties from its constituent elements
Pure	• Any Elements or Compounds

15.1 Composition of Matter

2. Which of the following is a pure substance?

A) Ocean water.

B) Blood.

C) Methane (CH_4).

D) Orange Juice.

(152 Major 2, Q13)

15.1 Composition of Matter

2. Which of the following is a pure substance?

A) Ocean water.

B) Blood.

C) Methane (CH_4).

D) Orange Juice.

(152 Major 2, Q13)

15.1 Composition of Matter

Name	Properties
Elements	• Anything made from all similar atoms • Basically all the things you see in periodic table • Cannot be broken down by chemical methods
Compounds	• Combination of 2 or more elements chemically bonded together • Cannot be separated into its elements by physical methods • Has different properties from its constituent elements
Pure	• **Any Elements or Compounds**

15.1 Composition of Matter

So look for any **Elements** or **Compounds**

A) Ocean water = mixture of salt + water

B) Blood = = mixture of water + plasma + cells + many things

C) Methane (CH_4) = this is a compound, made of the elements C and H Chemically joined together

D) Orange Juice = mixture of sugar + water + many things

15.1 Composition of Matter

3. Which of the following is a pure substance?

A) Sea water.

B) Baking soda ($NaHCO_3$).

C) Air.

D) Tea.

(162 Major 2, Q21)

15.1 Composition of Matter

3. Which of the following is a pure substance?

A) Sea water.

B) Baking soda ($NaHCO_3$).

C) Air.

D) Tea.

(162 Major 2, Q21)

15.1 Composition of Matter

Again, look for any **Elements** or **Compounds**

A) Sea water = mixture of salt + water

B) $NaHCO_3$ = this is a compound, made of the elements Na, C, O and H chemically joined together

C) Air = mixture of O_2 gas + N_2 gas + CO_2 gas + many other molecules

D) Tea = mixture of caffeine + water + many other molecules

15.1 Composition of Matter

4. Rust (Fe_2O_3) is a ______________.

A) homogeneous mixture

B) Pure substance

C) heterogeneous mixture

D) Physical Change.

(161 Major 2, Q12)

15.1 Composition of Matter

4. Rust (Fe_2O_3) is a ______________.

A) homogeneous mixture

B) Pure substance

C) heterogeneous mixture

D) Physical Change.

(161 Major 2, Q12)

15.1 Composition of Matter

Fe_2O_3 is a compound because:

Properties of compound	**Proof that it's true for Fe_2O_3**
Combination of 2 or more elements chemically bonded together	Yes it is made up of Fe and O Chemically bonded together
Cannot be separated into its elements by physical methods	It cannot be separated into Fe and O by simple physical methods like boiling or distillation
Has different properties from its constituent elements	The properties (melting point, boiling point, density etc) of Fe_2O_3 are very different from those of Fe and O alone

So the table has proven that Fe_2O_3 is a compound,

and compounds are pure substances.

Hence, Fe_2O_3 is a pure substance

15.1 Composition of Matter

5. Which of the following statements applies to mixtures?

A) They are made up of atoms that are all alike.

B) They have a fixed composition.

C) Cannot be separated by physical means.

D) They always contain the same proportions of the substances of which

they are made.

E) They are composed of two or more substances.

(142 Major 2, Q10)

15.1 Composition of Matter

5. Which of the following statements applies to mixtures?

A) They are made up of atoms that are all alike.

B) They have a fixed composition.

C) Cannot be separated by physical means.

D) They always contain the same proportions of the substances of which

they are made.

E) They are composed of two or more substances.

(142 Major 2, Q10)

15.1 Composition of Matter

- **The table says:**

Name	Properties
Mixture	• **<u>Made of 2 or more substances</u>** that can be separated by physical methods

15.1 Composition of Matter

6. Which of the following is NOT a mixture?

A) Paint.

B) Smoke.

C) Air.

D) Milk.

E) Helium.

(142 Major 2, Q8)

15.1 Composition of Matter

6. Which of the following is NOT a mixture?

A) Paint.

B) Smoke.

C) Air.

D) Milk.

E) Helium.

(142 Major 2, Q8)

15.1 Composition of Matter

7. _________ is a heterogeneous mixture with particles that never settle.

A) Colloid

B) Suspension

C) Solution

D) Compound

(161 Final, Q22)

15.1 Composition of Matter

7. __________ is a heterogeneous mixture with particles that never settle.

A) Colloid

B) Suspension

C) Solution

D) Compound

(161 Final, Q22)

15.1 Composition of Matter

Name	Properties
Suspension	• Heterogeneous mixture of solid and liquid particles • Particles will finally settle
Colloid	• <u>**Particles never settle**</u> • Light beam is visible due to scattering when passing through colloid (Tyndall effect)

15.1 Composition of Matter

8. A ______ is a heterogeneous mixture with particles that never settle.

A) Colloid.

B) Suspension.

C) Solution.

D) Compound.

E) None of these.

(142 Major 2, Q9)

15.1 Composition of Matter

8. A ______ is a heterogeneous mixture with particles that never settle.

A) Colloid.

B) Suspension.

C) Solution.

D) Compound.

E) None of these.

(142 Major 2, Q9)

15.1 Composition of Matter

Almost same as above question!!!

15.1 Composition of Matter

9. What do compounds and mixtures have in common?

A) Both are made up of substances that combine in a specific ratio.

B) Both are made from combinations of different substances.

C) Both are made up of substances that can be separated by physical means.

D) Both are made up of substances that can be separated by chemical means.

(152 Final, Q15)

15.1 Composition of Matter

9. What do compounds and mixtures have in common?

A) Both are made up of substances that combine in a specific ratio.

B) Both are made from combinations of different substances.

C) Both are made up of substances that can be separated by physical means.

D) Both are made up of substances that can be separated by chemical means.

(152 Final, Q15)

15.1 Composition of Matter

9. What do compounds and mixtures have in common?

A) WRONG! Only compounds are made up of substances that combine in a specific ratio. Mixtures can be mixed in any ratio that you like!

B) Yes! Both are made from combinations of different substances.

C) WRONG! Only mixtures can be separated by physical means.

D) WRONG! Normally, only compounds are separated by chemical means.

15.1 Composition of Matter

10. Which of the following is a suspension?

A) Tea.

B) Steel alloys.

C) Clouds.

D) River water.

E) Smoke.

(142 Final, Q29)

15.1 Composition of Matter

10. Which of the following is a suspension?

A) Tea.

B) Steel alloys.

C) Clouds.

D) River water.

E) Smoke.

(142 Final, Q29)

15.1 Composition of Matter

10. Which of the following is a suspension?

A) Tea = colloid(?). Most likely, since it's just like milk.

B) Steel alloys = homogeneous mixture (see p468, Fig. 11)

C) Clouds = colloid (discussed in next question)

D) River water = suspension (see p466 top)

E) Smoke = colloid

(142 Final, Q29)

15.1 Composition of Matter

11. Clouds in the sky are examples of a ____________.

A) colloid.

B) suspension.

C) homogeneous mixture.

D) pure substance.

(161 Major 2, Q13)

15.1 Composition of Matter

11. Clouds in the sky are examples of a ____________.

A) colloid.

B) suspension.

C) homogeneous mixture.

D) pure substance.

(161 Major 2, Q13)

15.1 Composition of Matter

11. Clouds in the sky are examples of a colloid because:

They are composed of water droplets that are much larger than molecules, but that are small enough that they do not settle down.

Source: https://courses.lumenlearning.com/wsu-sandbox2/chapter/colloids-2/

Also, clouds scatter light beam passing through →

15.1 Composition of Matter

12. The scattering of a light beam as it passes through ________ is called the Tyndall effect.

A) a gaseous element.

B) a colloid.

C) a compound.

D) a solution.

(171 Major 2, Q13)

15.1 Composition of Matter

12. The scattering of a light beam as it passes through ________ is called the Tyndall effect.

A) a gaseous element.

B) a colloid.

C) a compound.

D) a solution.

(171 Major 2, Q13)

15.1 Composition of Matter

13. A light beam is visible as it passes through?

A) hydrogen gas.

B) pure water.

C) a solution.

D) carbon dioxide gas.

E) None of these

(171 Final, Q14)

15.1 Composition of Matter

13. A light beam is visible as it passes through?

A) hydrogen gas.

B) pure water.

C) a solution.

D) carbon dioxide gas.

E) None of these

(171 Final, Q14)

15.1 Composition of Matter

A light beam is visible as it passes through a colloid. So check **which answer is a colloid?**

A) hydrogen gas = pure substance/element

B) pure water = pure substance/compound

C) a solution = homogeneous mixture

D) carbon dioxide gas = pure substance/compound

E) None of these

15.1 Composition of Matter

14. You can see Tyndall effect in

A) Fog

B) Air

C) Water

D) Hydrogen gas

(162 Major 2, Q22)

15.1 Composition of Matter

14. You can see Tyndall effect in

A) Fog

B) Air

C) Water

D) Hydrogen gas

(162 Major 2, Q22)

15.1 Composition of Matter

14. You can see Tyndall effect in a colloid.

So check which answer is a colloid?

A) Fog = colloid (see p466 Fig. 8)

B) Air = mixture

C) Water = pure substance/compound

D) Hydrogen gas = pure substance/element

(162 Major 2, Q22)

15.1 Composition of Matter

15. A light beam can be seen as it passes through

A) a colloid.

B) a solution.

C) a pure substance.

D) any mixture.

(152 Major 2, Q14)

15.1 Composition of Matter

15. A light beam can be seen as it passes through

A) a colloid.

B) a solution.

C) a pure substance.

D) any mixture.

(152 Major 2, Q14)

15.1 Composition of Matter

16. Which one of the following statements is correct?

A) Fog is a suspension.

B) A light beam can be seen as it passes through milk.

C) Carbon dioxide (CO_2) is a homogeneous mixture.

D) Smoke is a compound.

(151 Major 2, Q10)

15.1 Composition of Matter

16. Which one of the following statements is correct?

A) Fog is a suspension.

B) A light beam can be seen as it passes through milk.

C) Carbon dioxide (CO_2) is a homogeneous mixture.

D) Smoke is a compound.

(151 Major 2, Q10)

15.1 Composition of Matter

16. Which one of the following statements is correct?

A) Fog is a ~~suspension~~ colloid.

B) A light beam can be seen as it passes through milk. Yes because milk is a colloid (see p466)

C) Carbon dioxide (CO_2) is a ~~homogeneous mixture~~ pure substance/compound.

D) Smoke is a ~~compound~~ colloid (see p466 bottom).

15.2 Properties of Matter

15.2 Properties of Matter

4 key terms for this chapter are: <u>physical, chemical, properties and change.</u>

The easy way to understand difference between <u>Properties</u> and <u>change</u> is:

<u>Change</u> describes transformation in <u>properties</u> as time passes

<u>Properties</u> describe the object at a fixed point in time

E.g. state of matter is a physical <u>property</u>. It can be solid, liquid or gas

So, at 2 am today (fixed time), an object can be in solid state, for example.

if that state <u>changes</u> from solid to liquid as time passes, then this is a physical <u>change</u>

15.2 Properties of Matter

The main difference between physical and chemical is:

whether the Identity of substance changes or not.

If identity changes, then it is chemical change.

If identity remains fixed, then it is physical change.

what do we mean by identity?

it is basically the chemical formula of the substance (CO2, H2O, etc etc etc).

if this chemical formula changes, the identity changes and it is a chemical change.

15.2 Properties of Matter

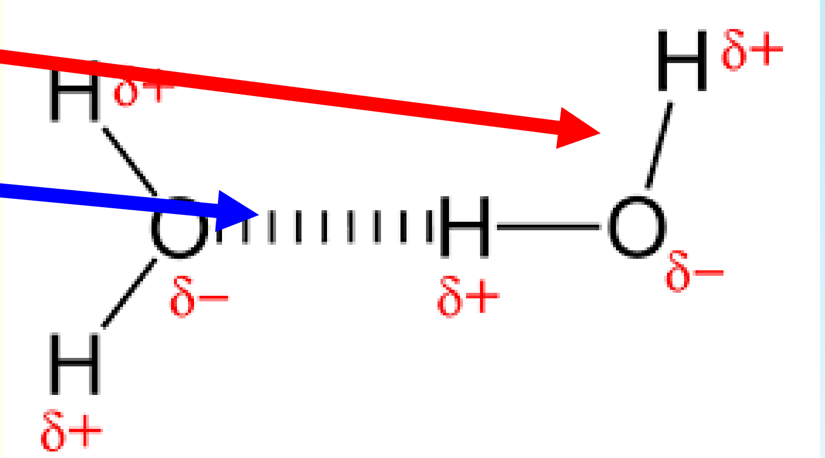
the real difference between physical and chemical change is: what type of Bonds are being broken and formed?

there are two types of bonds in substances: intermolecular (Inside the molecule) and intramolecular (from one molecule to another) bonds.

Now we study a simple example of water to understand the difference between physical and chemical change.

15.2 Properties of Matter

Just look at this example of water: there are **intra**molecular Bonds (between H and O) and **inter**molecular bonds (from one H2O molecule to another H2O)



during **physical** change (like melting or boiling) the **inter**molecular bonds are being broken.

During chemical change like breaking down water into hydrogen gas, it is the intramolecular bonds being broken (between H and O).

same thing goes for burning as well. during burning, we are Breaking the intramolecular bonds inside the molecules, and making new bonds, so this is a chemical change as new substances are being formed.

15.2 Properties of Matter

1. Which of the following does not represent a physical property or a physical change?

A) Elemental sulfur is rigid and hard.

B) Elemental sulfur boils at 445ºC.

C) Elemental sulfur burns with a dark blue flame in the air to form a gaseous material.

D) Elemental sulfur is yellow in its most common form.

(171 Major 2, Q12)

15.2 Properties of Matter

1. Which of the following does not represent a physical property or a physical change?

A) Elemental sulfur is rigid and hard.

B) Elemental sulfur boils at 445ºC.

C) Elemental sulfur burns with a dark blue flame in the air to form a gaseous material.

D) Elemental sulfur is yellow in its most common form.

(171 Major 2, Q12)

15.2 Properties of Matter

1. Which of the following does <u>**not**</u> represent a <u>**physical property**</u> or a <u>**physical change**</u>?

A) This is a physical property

B) This is a physical property

C) Burning is a chemical change that happens over time to form new substances (gaseous material)

D) This is a physical property

15.2 Properties of Matter

2. Which of the following physical properties are involved in the distillation of salt water?

A) Color.

B) Size.

C) Viscosity.

D) Boiling point.

E) Density.

(171 Final, Q15)

15.2 Properties of Matter

2. Which of the following physical properties are involved in the distillation of salt water?

A) Color.

B) Size.

C) Viscosity.

D) Boiling point.

E) Density.

(171 Final, Q15)

15.2 Properties of Matter

For distillation of anything (salt water/crude oil etc), it is based on the differences in boiling point Of the different liquids in a mixture

Example: crude oil contains a mixture of oil 1, oil 2, oil 3 etc And they all have different boiling points.

So the lowest boiling point will come out first, then the next higher boiling, and so on.

Please read textbook page 472 (top)

15.2 Properties of Matter

3. Which of the following physical properties is used in the distillation of crude oil?

A) Viscosity.

B) Color.

C) Boiling point.

D) Density.

(161 Major 2, Q14)

15.2 Properties of Matter

3. Which of the following physical properties is used in the distillation of crude oil?

A) Viscosity.

B) Color.

C) Boiling point.

D) Density.

(161 Major 2, Q14)

15.2 Properties of Matter

Same question as above!

15.2 Properties of Matter

4. Which physical property is involved in the distillation of two liquids mixed together?

A) Surface tension.

B) Color.

C) Boiling point.

D) Viscosity.

E) Melting point.

(142 Major 2, Q13)

15.2 Properties of Matter

4. Which physical property is involved in the distillation of two liquids mixed together?

A) Surface tension.

B) Color.

C) Boiling point.

D) Viscosity.

E) Melting point.

(142 Major 2, Q13)

15.2 Properties of Matter

Same question as above!!!

15.2 Properties of Matter

5. Which of the following elements is not a good conductor for heat and electricity?

A) Chromium (Cr).

B) Rubidium (Rb).

C) Phosphorus (P).

D) Titanium (Ti).

(162 Final, Q5)

15.2 Properties of Matter

5. Which of the following elements is not a good conductor for heat and electricity?

A) Chromium (Cr).

B) Rubidium (Rb).

C) Phosphorus (P).

D) Titanium (Ti).

(162 Final, Q5)

15.2 Properties of Matter

In general, metal are good conductors of electricity (you already know that). That's why we use copper for wires and gold/silver for computer chips.

for the same reason that metals conduct electricity well, they also can conduct heat well. because the free electron that carry electric current can also carry thermal current (heat)

So question say not good conductor of heat and electricity, look out for nonmetals

from periodic table, look at the right side. only option is phosphorus

15.2 Properties of Matter

6. An example of a physical change is

A) Burning a log of wood.

B) Rusting of a nail.

C) Sublimation of dry ice at room temperature.

D) A copper statue turning to green.

E) Ripening of an apple.

(142 Major 2, Q12)

15.2 Properties of Matter

6. An example of a physical change is

A) Burning a log of wood.

B) Rusting of a nail.

C) Sublimation of dry ice at room temperature.

D) A copper statue turning to green.

E) Ripening of an apple.

(142 Major 2, Q12)

15.2 Properties of Matter

6. An example of a physical change is

A) Burning = Reaction of wood with oxygen in air to form new products (CO_2, Ash, etc). Chemical change.

B) Rusting of nail = Reaction of iron (Fe) with oxygen in air to form new product (Fe2O3 = rust). Chemical change.

C) Sublimation of dry ice at room temperature = Change of state of from CO2 solid to CO2 gas. no new substances are formed. Physical change.

D) A copper statue turning to green:

Cu → CuSO4. Reaction of copper metal to form new compound. Chemical change.

E) Ripening of an apple = Reaction of apple with oxygen in air and maybe bacteria to form new products, that is why the color, smell and taste of ripe apple is different. Chemical change.

15.2 Properties of Matter

7. Which of the following properties of the element zirconium is chemical?

A) is resistant to corrosion.

B) melts at 1852ºC.

C) has a grayish-white color.

D) is a shiny metal.

(162 Major 2, Q24)

15.2 Properties of Matter

7. Which of the following properties of the element zirconium is chemical?

A) is resistant to corrosion.

B) melts at 1852ºC.

C) has a grayish-white color.

D) is a shiny metal.

(162 Major 2, Q24)

15.2 Properties of Matter

7. Which of the following properties of the element zirconium is chemical?

A) is resistant to corrosion = chemical property. Because if it can Corrode (rust), it will be a chemical property since new products are formed. So being resistant to corrosion is also a chemical property.

B) melts at 1852ºC = Physical property

C) has a grayish-white color = color is a Physical property (see p469)

D) is a shiny metal = color is a Physical property (see p469)

15.2 Properties of Matter

8. Which of the following is a chemical property?

A) Viscosity.

B) Reaction to light.

C) Melting point.

D) Inertia.

(152 Major 2, Q16)

15.2 Properties of Matter

8. Which of the following is a chemical property?

A) Viscosity.

B) Reaction to light.

C) Melting point.

D) Inertia.

(152 Major 2, Q16)

15.2 Properties of Matter

8. Which of the following is a chemical property?

A) Whether an object is high viscosity (eg honey) or low viscosity (eg water), it depends on the intermolecular bond not intramolecular Bond. please see the earlier pages for the meaning of these words. Hence it is a physical property.

B) Any type of reaction weather with light or oxygen or fire Normally involves forming of new compounds… hence chemical change

C) Change of state are always physical change because no new substances are formed.

D) Inertia. Inertia depends on mass. E.g. if we have two blocks of pure iron, one big and one small, They have the same identity/chemical composition Even though their mass (= inertia) is different. so this means inertia does not affect the identity, so it is a physical property.

15.2 Properties of Matter

9. Which of these warnings refers to a chemical property of the material?

A) Fragile.

B) Highly toxic.

C) Sharp object.

D) Shake well.

E) Slippery floor.

(142 Major 2, Q11)

15.2 Properties of Matter

9. Which of these warnings refers to a chemical property of the material?

A) Fragile.

B) Highly toxic.

C) Sharp object.

D) Shake well.

E) Slippery floor.

(142 Major 2, Q11)

15.2 Properties of Matter

9. Which of these warnings refers to a chemical property of the material?

A) Fragile = Can break easily into smaller pieces (change size/shape). so physical property

B) Highly toxic = Means it will react with molecules inside body to produce harmful substances, so chemical change as new substances are produced

C) Sharp object = Refers to the shape of object. so physical property.

D) It means the solid well settle down To bottom after sometime (like suspension). by shaking, we are not creating in new substances, just moving around what is already there. so this is a physical property.

E) Slippery floor = physical property.

15.2 Properties of Matter

10. Which of the followings is a chemical change?

A) Sugar dissolves in water.

B) An enzyme breaks down the lactose in milk.

C) An ice cube melts to form liquid water.

D) Garlic is chopped into small pieces.

(162 Major 2, Q23)

15.2 Properties of Matter

10. Which of the followings is a chemical change?

A) Sugar dissolves in water.

B) An enzyme breaks down the lactose in milk.

C) An ice cube melts to form liquid water.

D) Garlic is chopped into small pieces.

(162 Major 2, Q23)

15.2 Properties of Matter

10. Which of the followings is a chemical change?

A) Sugar dissolves in water = physical, as no new products form

B) breaks down lactose in milk = new products form e.g. glucose etc so chemical change.

C) An ice cube melts to form liquid water = physical change, as no new products form

D) Garlic is chopped into small pieces = physical change, as no new products are form

15.2 Properties of Matter

11. Which of the following statements is correct?

A) In any chemical change, the total mass of the products must be less than the total mass of the reactants.

B) Formation of a solid precipitate when two liquids are mixed together is a sign that a chemical change has occurred.

C) Sublimation is a chemical change.

D) Ability to rust is a physical property of iron.

(161 Major 2, Q15)

15.2 Properties of Matter

11. Which of the following statements is correct?

A) In any chemical change, the total mass of the products must be less than the total mass of the reactants.

B) Formation of a solid precipitate when two liquids are mixed together is a sign that a chemical change has occurred.

C) Sublimation is a chemical change.

D) Ability to rust is a physical property of iron.

(161 Major 2, Q15)

15.2 Properties of Matter

12. Which of the following statements is FALSE?

A) Viscosity is a physical property.

B) Rusting is a slow chemical change.

C) Boiling is a physical change.

D) During a chemical change, the composition of matter does not change.

(152 Final, Q16)

15.2 Properties of Matter

12. Which of the following statements is FALSE?

A) Viscosity is a physical property.

B) Rusting is a slow chemical change.

C) Boiling is a physical change.

D) During a chemical change, the composition of matter does not change.

(152 Final, Q16)

15.2 Properties of Matter

12. Which of the following statements is FALSE?

A) Viscosity = physical property. Correct!

B) Rusting = slow chemical change. Correct!

C) Boiling (liquid → gas) is a physical change. Correct!

D) During a chemical change, the composition of matter does not change. Wrong! the composition changes, as new products are formed and old ones are destroyed.

15.2 Properties of Matter

13. Which of the following could be an example of a chemical change?

A) Weathering of limestone.

B) Boiling water in a kettle..

C) Breaking a chalk.

D) Compressing a spring.

(151 Major 2, Q11)

15.2 Properties of Matter

13. Which of the following could be an example of a chemical change?

A) Weathering of limestone.

B) Boiling water in a kettle..

C) Breaking a chalk.

D) Compressing a spring.

(151 Major 2, Q11)

15.2 Properties of Matter

13. Which of the following **could** be an example of a chemical change?

A) Weathering of limestone = Weathering could be physical change or chemical change (see p474 bottom). So it is the only suitable answer

B) Boiling water in a kettle = change of state = physical

C) Breaking a chalk = change of size = physical

D) Compressing a spring = change of shape = physical

15.2 Properties of Matter

14. Which statement best describes the law of conservation of mass?

A) Matter is neither lost nor gained during a chemical change.

B) The mass of the products is always greater than the mass of the materials that react in a chemical change.

C) A certain mass of material must be present for a reaction to occur.

D) The mass of the products is always less than the mass of the materials that react in a chemical change.

(171 Major 2, Q14)

15.2 Properties of Matter

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C) A certain mass of material must be present for a reaction to occur.

D) The mass of the products is always less than the mass of the materials that react in a chemical change.

(171 Major 2, Q14)

15.2 Properties of Matter

This is just the definition of the law of conservation of mass:

Matter is neither lost nor gained during a chemical change.

Which means: <u>Mass of Reactants</u> = <u>Mass of Products</u>

Or we say: <u>Mass before reaction</u> = <u>Mass after reaction</u>

15.2 Properties of Matter

15. Sulfur dioxide reacts with bromine and water to produce hydrogen bromide and sulfuric acid. If 64.10 g of sulfur dioxide reacts completely with 159.9 g of bromine and an unknown amount of water to form 161.9 g of hydrogen bromide and 98.10 g of sulfuric acid, then how many grams of water react?

A) 260.0 g

B) 484.0 g

C) 125.9 g

D) 36.00 g

(162 Major 2, Q25)

15.2 Properties of Matter

15. Sulfur dioxide reacts with bromine and water to produce hydrogen bromide and sulfuric acid. If 64.10 g of sulfur dioxide reacts completely with 159.9 g of bromine and an unknown amount of water to form 161.9 g of hydrogen bromide and 98.10 g of sulfuric acid, then how many grams of water react?

A) 260.0 g

B) 484.0 g

C) 125.9 g

D) 36.00 g

(162 Major 2, Q25)

15.2 Properties of Matter

Read carefully to find the reactants and products

Reactants = before reaction = Sulfur dioxide + bromine + water

Products = After reaction = hydrogen bromide + sulfuric acid

law of conservation of mass says: Mass of Reactants = Mass of Products

Mass of Sulfur dioxide + bromine + water = Mass of hydrogen bromide + sulfuric acid

64.10 g + 159.9 g + ??? g = 161.9 g + 98.10 g

??? = 161.9 g + 98.10 g – 64.10 g + 159.9 g = 36.00 g

15.2 Properties of Matter

16. Sulfur dioxide reacts with bromine and water to produce hydrogen bromide and sulfuric acid. If 64.10 g of sulfur dioxide react completely with 159.9 g of bromine and an unknown amount of water to form 161.9 g of hydrogen bromide and 98.10 g of sulfuric acid, then how many grams of water react?

A) 195.9 g

B) 36.00 g

C) 260.0 g

D) 100.1 g

(161 Final, Q21)

15.2 Properties of Matter

16. Sulfur dioxide reacts with bromine and water to produce hydrogen bromide and sulfuric acid. If 64.10 g of sulfur dioxide react completely with 159.9 g of bromine and an unknown amount of water to form 161.9 g of hydrogen bromide and 98.10 g of sulfuric acid, then how many grams of water react?

A) 195.9 g

B) 36.00 g

C) 260.0 g

D) 100.1 g

(161 Final, Q21)

15.2 Properties of Matter

Read carefully to find the reactants and products

Reactants = before reaction = Sulfur dioxide + bromine + water

Products = After reaction = hydrogen bromide + sulfuric acid

law of conservation of mass says: Mass of Reactants = Mass of Products

Mass of Sulfur dioxide + bromine + water = Mass of hydrogen bromide + sulfuric acid

64.10 g + 159.9 g + ??? g = 161.9 g + 98.10 g

??? = 161.9 g + 98.10 g – 64.10 g + 159.9 g = 36.00 g

15.2 Properties of Matter

17. When methane reacts with oxygen, the products are carbon dioxide and water. How many grams of water are formed if 30 g of methane react completely with 98 g of oxygen to form 76 g of carbon dioxide?

A) 128 g.

B) 52 g.

C) 76 g.

D) 204 g.

E) Zero.

(142 Major 2, Q14)

15.2 Properties of Matter

17. When methane reacts with oxygen, the products are carbon dioxide and water. How many grams of water are formed if 30 g of methane react completely with 98 g of oxygen to form 76 g of carbon dioxide?

A) 128 g.

B) 52 g.

C) 76 g.

D) 204 g.

E) Zero.

(142 Major 2, Q14)

15.2 Properties of Matter

Read carefully to find the reactants and products

Reactants = before reaction = methane + oxygen

Products = After reaction = carbon dioxide + water

law of conservation of mass says: Mass of Reactants = Mass of Products

Mass of methane + oxygen = Mass of carbon dioxide + water

30 g + 98 g = 76 g + ??? g

??? = 30 g + 98 g – 76 g = 52 g

16.1 Structure of the Atom

16.1 Structure of the Atom

1. Which of the following statements is FALSE?

A) A neutron has twice the mass of a proton.

B) The nucleus contains most of the mass of an atom.

C) There are three quarks in every proton or neutron.

D) A proton and an electron have opposite electric charges.

(171 Major 2, Q15)

16.1 Structure of the Atom

1. Which of the following statements is FALSE?

A) A neutron has twice the mass of a proton.

B) The nucleus contains most of the mass of an atom.

C) There are three quarks in every proton or neutron.

D) A proton and an electron have opposite electric charges.

(171 Major 2, Q15)

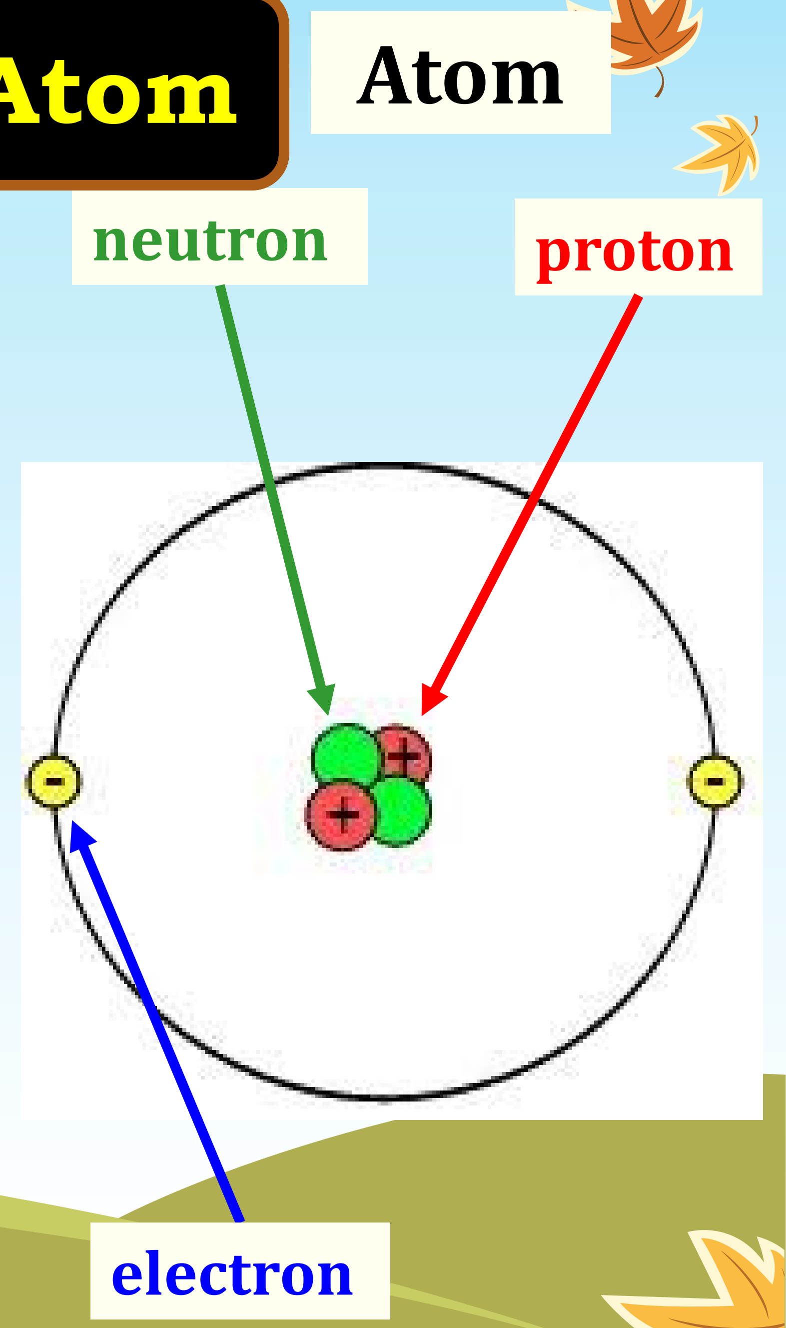
16.1 Structure of the Atom

The electron has very small mass ($\sim\frac{1}{1800}$ of proton or neutron mass), and mass of proton and neutron are roughly the same, (Note: neutron is very slightly heavier than proton) So A is wrong.

Remember! Atom = $\underbrace{\text{protons + neutrons}}_{\text{Nucleus}}$ + electrons

Now, nucleus contains ALL protons + neutrons.

Since electron is very very light, most mass of atom is within the protons and neutrons i.e. nucleus. So B is right.



16.1 Structure of the Atom

C) Yes true, see p489 bottom

D) Yes true, see p489 middle. Since charge of Proton = +1 & charge of electron = -1, so they are opposite charges

16.1 Structure of the Atom

2. Which of the following is a fundamental particle (not made of smaller particles)?

A) Proton.

B) Electron.

C) Neutron.

D) Atom.

(151 Major 2, Q13)

16.1 Structure of the Atom

2. Which of the following is a fundamental particle (not made of smaller particles)?

A) Proton.

B) Electron.

C) Neutron.

D) Atom.

(151 Major 2, Q13)

16.1 Structure of the Atom

2. Which of the following is a fundamental particle (not made of smaller particles)?

A) Proton = 3 quarks

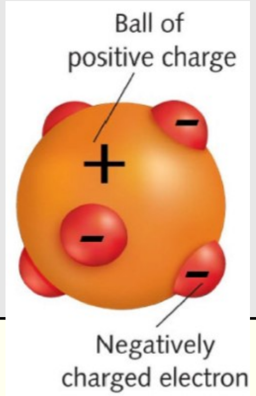
B) Electron = Not made of smaller particles (see p489 bottom)

C) Neutron = 3 quarks (But different arrangement from proton - see p489 bottom)

D) Atom = protons + neutrons + electrons, so it is obviously not a fundamental particle.

16.1 Structure of the Atom

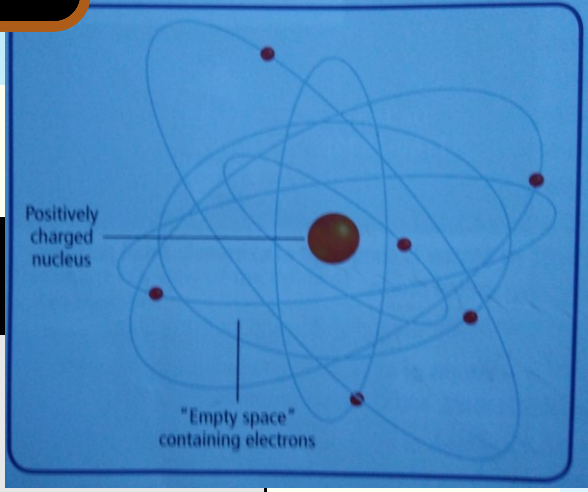
There are 6 atomic models to learn:

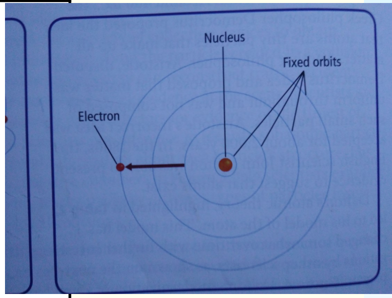
Name	Year	Main Ideas
Democritus	400 B.C.	Elements consist tiny, solid "uncuttable" particles called atomos. Disagreed with Aristotle 
Dalton	1800s	• Gave evidence that atoms exist • This helped explain chemical reactions • Wrote Dalton's atomic theory (6 points)
Thomson	1904	Atoms made of: uniform positively-charged sphere in which small, negative particles were uniformly embedded 

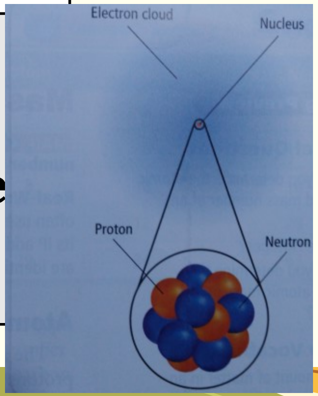
16.1 Structure of the Atom

There are 6 atomic models to learn:

Name	Year	Main Ideas
Rutherford	1911	• All positive charge concentrated in central nucleus • Electrons flying around nucleus
Bohr	1913	• Electrons travel in fixed orbits around nucleus • Electrons can jump between orbits as they absorb/release specific amounts of energy • Good for hydrogen atom, Not so good for other atom
Electron cloud	1926	• Electron cloud is area around nucleus where electrons are moving • Impossible to find exact location of electron at any one time







16.1 Structure of the Atom

3. Which of the following is not in Dalton's atomic theory?

A) Atoms of a specific element are different from those of another element.

B) Atoms are composed of subatomic particles called protons, neutrons, and electrons.

C) Atoms are indivisible and indestructible.

D) Different atoms combine in simple whole-number ratios to form compounds.

(171 Major 2, Q16)

16.1 Structure of the Atom

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D) Different atoms combine in simple whole-number ratios to form compounds.

(171 Major 2, Q16)

16.1 Structure of the Atom

This is just a memorizing type question on Dalton atomic theory, which has 6 points. You should try to memorize the proper theory from your text book p491. Otherwise at least try to memorize the summarised points below:

1. all matter is made from atoms
2. atoms cannot be broken down
3. atoms of a particular element have same properties
4. atoms of different element have different properties
5. different atoms combine in nice ratios to form compounds
6. during chemical reaction, Atoms can combine, separate or rearrange

16.1 Structure of the Atom

So answer A, C and D are from the theory but B is not. even if you forget everything, just think as follows:

A,C,D are all talking about general atom properties, but b is more advanced (it talks about proton, neutron and electron). From common sense, we know an advanced theory must come many years after general theory. so that is the only suitable answer.

16.1 Structure of the Atom

4. Which of the following is not part of Dalton's Atomic Theory?

A) Atoms are indivisible and indestructible.

B) Atoms of a given element are identical in size, mass, and chemical properties.

C) Matter is composed of extremely small particles called atoms.

D) There are protons in the nucleus of atoms.

(151 Major 2, Q15)

16.1 Structure of the Atom

4. Which of the following is not part of Dalton's Atomic Theory?

A) Atoms are indivisible and indestructible.

B) Atoms of a given element are identical in size, mass, and chemical properties.

C) Matter is composed of extremely small particles called atoms.

D) There are protons in the nucleus of atoms.

(151 Major 2, Q15)

16.1 Structure of the Atom

4. Which of the following is not part of Dalton's Atomic Theory?

A) Atoms are indivisible and indestructible = point 2

B) Atoms of a given element are identical in size, mass, and chemical properties = point 3

C) Matter is composed of extremely small particles called atoms = point 1

D) There are protons in the nucleus of atoms – Rutherford model – NOT part of Dalton's Atomic Theory.

16.1 Structure of the Atom

5. Which of the following statements is not correct?

A) Around 400 B.C., the Greek Philosopher Aristotle proposed for the first time the idea that atoms are tiny particles that make up all matter.

B) In Thomson atomic model there is no nucleus for the atom.

C) Bohr atomic model is better than Rutherford atomic model in describing the atom.

D) In the electron cloud model of an atom, electrons do not travel in fixed orbits around the nucleus.

(162 Final, Q6)

16.1 Structure of the Atom

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D) In the electron cloud model of an atom, electrons do not travel in fixed orbits around the nucleus.

(162 Final, Q6)

16.1 Structure of the Atom

5. Which of the following statements is not correct?

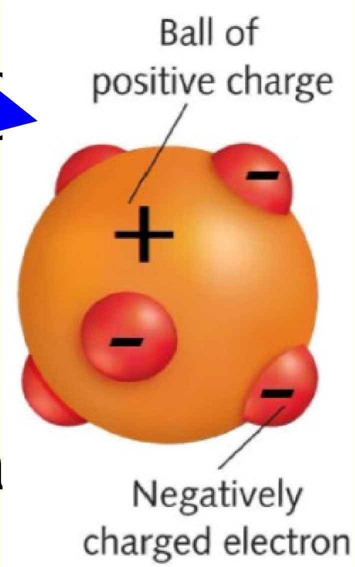
A) WRONG, it was Democritus, not Aristotle.

B) Yes, There is no small nucleus at the center.

C) Yes, it has these good ideas (not found in Rutherford)

1. Electrons can jump between orbits as they absorb/ release specific amounts of energy
2. Good for hydrogen atom, Not so good for other atom

D) Correct, it is like the spokes of a bicycle wheel.



16.1 Structure of the Atom

6. In Bohr's atomic model, electrons are located

A) at fixed points around the nucleus.

B) in the electron cloud.

C) inside the nucleus.

D) in fixed orbits around the nucleus.

(161 Major 2, Q17)

16.1 Structure of the Atom

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(161 Major 2, Q17)

16.1 Structure of the Atom

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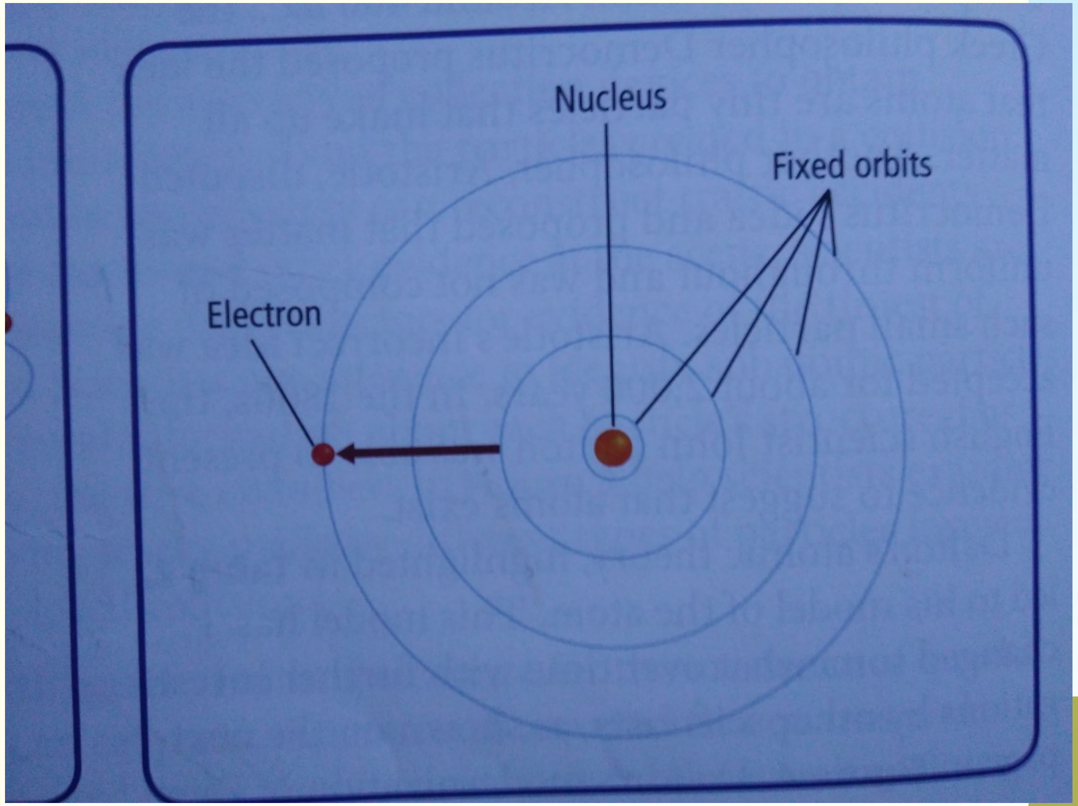


16.1 Structure of the Atom

7. Which atomic model is represented in the figure below?

A) Thomson model.

B) Democritus model.

C) Bohr model.

D) Rutherford Model.

(152 Major 2, Q17)

16.1 Structure of the Atom

7. Which atomic model is represented in the figure below?

A) Thomson model.

B) Democritus model.

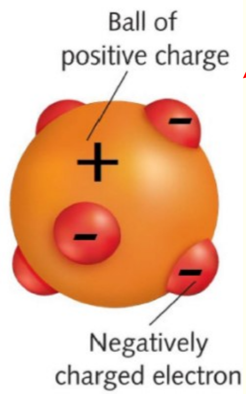
C) Bohr model.

D) Rutherford Model.

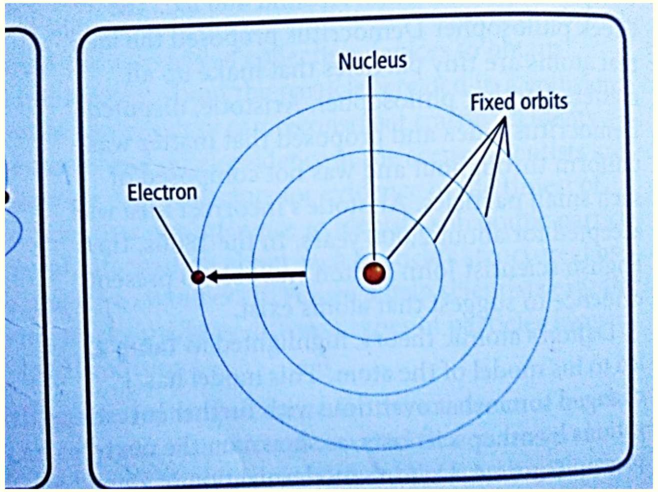
(152 Major 2, Q17)

16.1 Structure of the Atom

A) Thomson model.

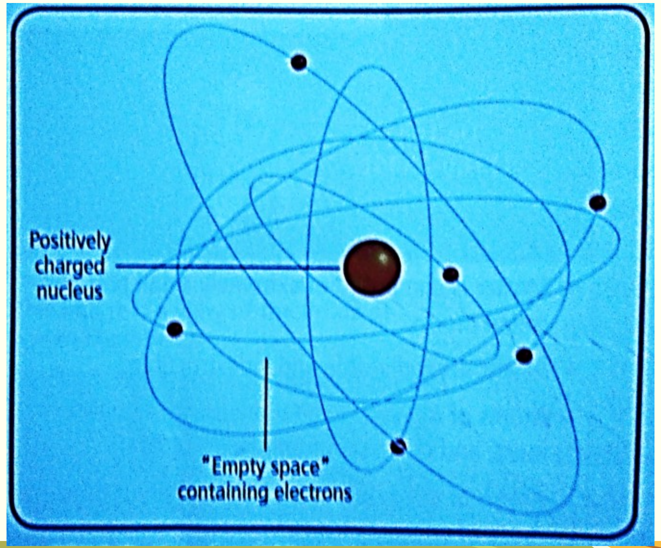


B) Democritus model.



C) Bohr model.

D) Rutherford Model.



16.1 Structure of the Atom

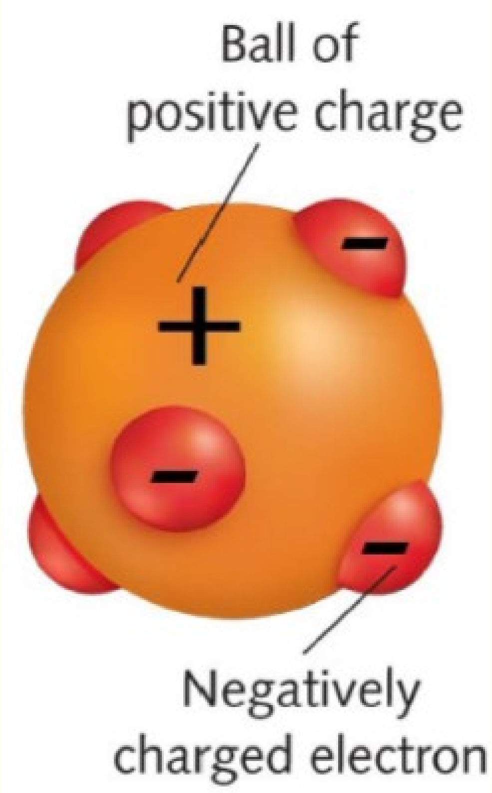
8. Which atomic model is represented in the figure below?

A) Thomson Model

B) Bohr Model

C) Democritus Model

D) Electron Cloud Model



(151 Final, Q9)

16.1 Structure of the Atom

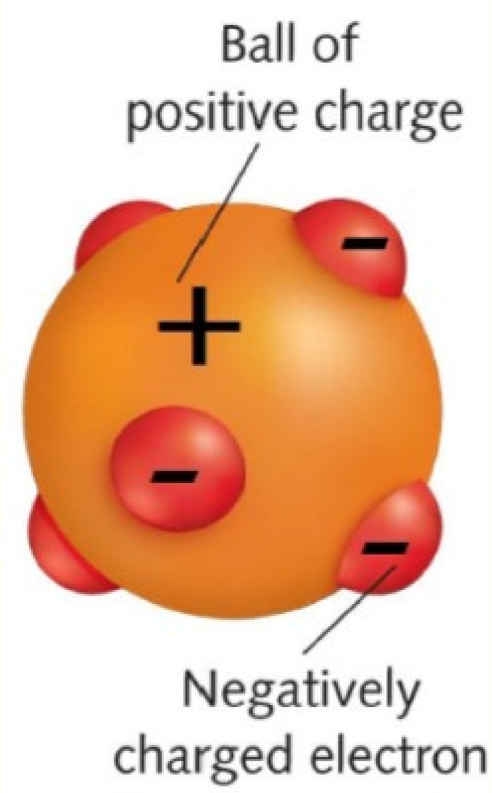
8. Which atomic model is represented in the figure below?

A) Thomson Model

B) Bohr Model

C) Democritus Model

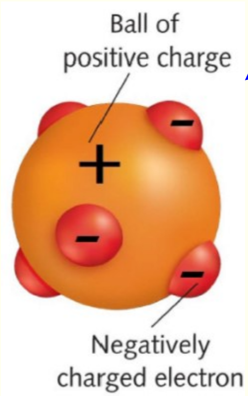
D) Electron Cloud Model

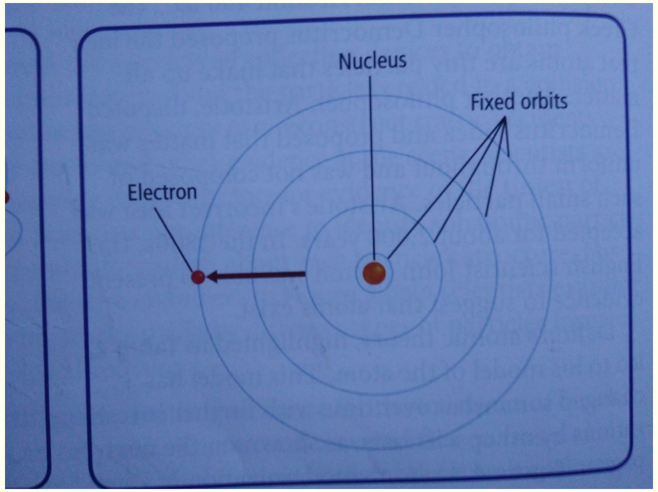


(151 Final, Q9)

16.1 Structure of the Atom

A) Thomson model.

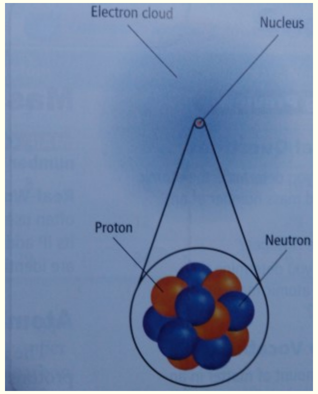




B) Bohr model.

C) Democritus model.

D) Electron cloud Model.



16.1 Structure of the Atom

9. In the current model of the atom, the electrons are located

A) inside the nucleus.

B) in the electron cloud.

C) in fixed orbits around the nucleus.

D) at fixed points around the nucleus.

(151 Major 2, Q14)

16.1 Structure of the Atom

9. In the current model of the atom, the electrons are located

A) inside the nucleus.

B) in the electron cloud.

C) in fixed orbits around the nucleus.

D) at fixed points around the nucleus.

(151 Major 2, Q14)

16.1 Structure of the Atom

This one is easy, the latest model is the electron cloud model, where electrons are located in the electron cloud.

16.2 Masses of Atoms

16.2 Masses of Atoms

1. Which has <u>more atoms</u>: a one-gram sample of carbon-12 or a one-gram sample of carbon-13?

A) They have the same number of atoms.

B) More information is needed.

C) A one-gram sample of carbon-12.

D) A one-gram sample of carbon-13.

(151 Major 2, Q17)

16.2 Masses of Atoms

1. Which has <u>more atoms</u>: a one-gram sample of carbon-12 or a one-gram sample of carbon-13?

A) They have the same number of atoms.

B) More information is needed.

C) A one-gram sample of carbon-12.

D) A one-gram sample of carbon-13.

(151 Major 2, Q17)

16.2 Masses of Atoms

Atoms are counted in moles:

1 mol = 6.023 x 10^{23} atoms (so it is just a very big number)

No of moles = mass/molar mass

molar mass = 12 g/mol for carbon-12

No of moles of atoms in 1 g of carbon-12 = $\frac{1\ g}{12\ g/mol} = \frac{1}{12}$ moles

No of moles of atoms in 1 g of carbon-13 = $\frac{1\ g}{13\ g/mol} = \frac{1}{13}$ moles

$\frac{1}{12} > \frac{1}{13}$, so more atoms in 1 g of carbon-12 than 1 g of carbon-13.

16.2 Masses of Atoms

2. The atomic number is

A) the number of protons in an atom’s nucleus.

B) the number of neutrons in an atom’s nucleus.

C) the number of electrons in an atom’s nucleus.

D) the total number of protons and neutrons in an atom’s nucleus.

(162 Final, Q14)

16.2 Masses of Atoms

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A) the number of protons in an atom's nucleus.

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C) the number of electrons in an atom's nucleus.

D) the total number of protons and neutrons in an atom's nucleus.

(162 Final, Q14)

16.2 Masses of Atoms

3. If two protons and two neutrons are removed from the nucleus of an oxygen-16 atom, a nucleus of which element remains?

A) Carbon

B) Beryllium

C) Magnesium

D) Neon

E) Oxygen

(142 Major 2, Q20)

16.2 Masses of Atoms

3. If two protons and two neutrons are removed from the nucleus of an oxygen-16 atom, a nucleus of which element remains?

A) Carbon

B) Beryllium

C) Magnesium

D) Neon

E) Oxygen

(142 Major 2, Q20)

16.2 Masses of Atoms

In periodic table: oxygen-16 atom is $^{16}_{8}O$

8 = protons

Remove 2 protons, we get 6 protons.

Only carbon has 6 protons. So you don't even have to worry about the neutrons at all!

16.2 Masses of Atoms

4. How many neutrons are in the nucleus of a bromine atom that has a mass number of 80?

A) 35.

B) 45.

C) 80.

D) 115.

(171 Major 2, Q17)

16.2 Masses of Atoms

4. How many neutrons are in the nucleus of a bromine atom that has a mass number of 80?

A) 35.

B) 45.

C) 80.

D) 115.

(171 Major 2, Q17)

16.2 Masses of Atoms

In periodic table: $^{80}_{35}Br$

35 = protons

80 = protons + neutrons

Neutrons = 80 – 35 = 45

16.2 Masses of Atoms

5. How many neutrons does iodine-127 have?

A) 74.

B) 53.

C) 127.

D) 7.

(162 Final, Q2)

16.2 Masses of Atoms

5. How many neutrons does iodine-127 have?

A) 74.

B) 53.

C) 127.

D) 7.

(162 Final, Q2)

16.2 Masses of Atoms

iodine-127 has 127 protons + neutrons

From periodic table, iodine has 53 protons

53 = protons

127 = protons + neutrons

Neutrons = 127 – 53 = 74

16.2 Masses of Atoms

6. How many neutrons are there in potassium-40?

A) 40

B) 19

C) 21

D) 20

(152 Major 2, Q18)

16.2 Masses of Atoms

6. How many neutrons are there in potassium-40?

A) 40

B) 19

C) 21

D) 20

(152 Major 2, Q18)

16.2 Masses of Atoms

potassium-40 has 40 protons + neutrons

From periodic table, iodine has 19 protons

19 = protons

40 = protons + neutrons

Neutrons = 40 – 19 = 21

16.2 Masses of Atoms

7. What is the number of neutrons in uranium-235?

A) 143

B) 92

C) 238

D) 235

E) 3

(142 Major 2, Q19)

16.2 Masses of Atoms

7. What is the number of neutrons in uranium-235?

A) 143

B) 92

C) 238

D) 235

E) 3

(142 Major 2, Q19)

16.2 Masses of Atoms

uranium-235 has 235 protons + neutrons

From periodic table, iodine has 19 protons

92 = protons

235 = protons + neutrons

Neutrons = 235 – 92 = 143

16.2 Masses of Atoms

8. The element bromine, Br, has two major isotopes of similar abundance, both around 50 percent. What is the most likely set of mass numbers for these isotopes?

A) Br-78, Br-79

B) Br-79, Br-81

C) Br-79, Br-80

D) Br-80, Br-81

E) Br-81, Br-82

(171 Final, Q16)

16.2 Masses of Atoms

8. The element bromine, Br, has two major isotopes of similar abundance, both around 50 percent. What is the most likely set of mass numbers for these isotopes?

A) Br-78, Br-79

B) Br-79, Br-81

C) Br-79, Br-80

D) Br-80, Br-81

E) Br-81, Br-82

(171 Final, Q16)

16.2 Masses of Atoms

- From periodic table, $^{79.9}_{35}\text{Br}$
- 79.9 = atomic mass (average) of all bromine isotopes
- Which pair of isotopes gives average atomic mass = 79.9???
- $79 \times \frac{50}{100} + 81 \times \frac{50}{100} = 80$ (close to 79.9)
- Hence, only Br-79, Br-81 is correct.
- The other isotope pairs do not average out to 79.9

16.2 Masses of Atoms

9. The three naturally occurring isotopes of hydrogen are hydrogen-1, hydrogen-2, and hydrogen-3. What is the number of neutrons that most hydrogen atoms have?

A) 1 neutron

B) 2 neutrons

C) 3 neutrons

D) 0 neutrons

(152 Final, Q17)

16.2 Masses of Atoms

9. The three naturally occurring isotopes of hydrogen are hydrogen-1, hydrogen-2, and hydrogen-3. What is the number of neutrons that most hydrogen atoms have?

A) 1 neutron

B) 2 neutrons

C) 3 neutrons

D) 0 neutrons

(152 Final, Q17)

16.2 Masses of Atoms

- From periodic table, ${}^{1.01}_{1}H$
- 1.01 = atomic mass (average) of all hydrogen isotopes
- Suppose all hydrogen is only hydrogen-1.
- $1 \text{ x } \frac{100}{100} + 2 \text{ x } \frac{0}{100} + 2 \text{ x } \frac{0}{100} = 1$ (close to 1.01)
- Hence, most isotopes are indeed hydrogen-1. Very, very few are hydrogen-2 and hydrogen-3.
- hydrogen-1 has 1 proton and 0 neutron.

16.2 Masses of Atoms

10. Which of the following are isotopes of the same element?

I) $^{16}_{8}X_1$ II) $^{14}_{5}X_2$ III) $^{16}_{7}X_3$ IV) $^{13}_{6}X_4$ V) $^{12}_{8}X_5$

A) (I) and (V).

B) (I) and (III).

C) (III) and (IV).

D) (II) and (V).

(162 Final, Q1)

16.2 Masses of Atoms

10. Which of the following are isotopes of the same element?

I) ${}^{16}_{8}X_1$ II) ${}^{14}_{5}X_2$ III) ${}^{16}_{7}X_3$ IV) ${}^{13}_{6}X_4$ V) ${}^{12}_{8}X_5$

A) (I) and (V).

B) (I) and (III).

C) (III) and (IV).

D) (II) and (V).

(162 Final, Q1)

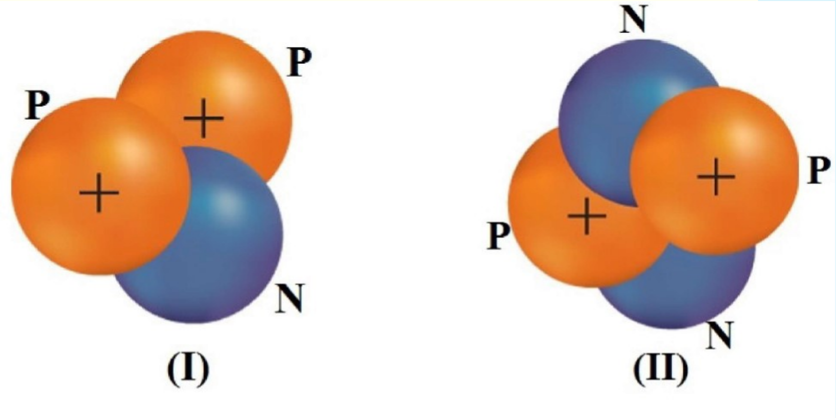
16.2 Masses of Atoms

"isotopes of the same element" have the same proton (atomic) number, which is the lower number.

- So $^{16}_{8}X$ and $^{12}_{8}X$ have same proton (atomic) number = isotopes

16.2 Masses of Atoms

11. (I) and (II) are diagrams of two nuclei, where P stands for proton and N stands for neutron, which of the following is TRUE?



A) (I) and (II) are isotopes of helium.

B) (I) and (II) are isotopes of different elements.

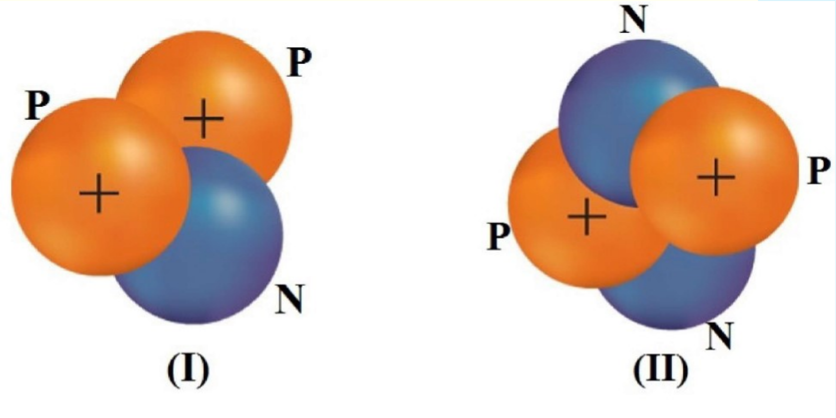
C) (I) and (II) have the same atomic mass.

D) (I) and (II) have different atomic numbers.

(161 Major 2, Q16)

16.2 Masses of Atoms

11. (I) and (II) are diagrams of two nuclei, where P stands for proton and N stands for neutron, which of the following is TRUE?



A) (I) and (II) are isotopes of helium.

B) (I) and (II) are isotopes of different elements.

C) (I) and (II) have the same atomic mass.

D) (I) and (II) have different atomic numbers.

(161 Major 2, Q16)

16.2 Masses of Atoms

- Both have exactly 2 neutrons so both are isotopes of helium

16.2 Masses of Atoms

12. Magnesium has three isotopes, magnesium-24, magnesium-25, and magnesium-26. Which isotope is more naturally abundant than the others?

A) Magnesium-26

B) Magnesium-25

C) Magnesium-24

D) All are naturally abundant by equal percentages.

(162 Final, Q3)

16.2 Masses of Atoms

12. Magnesium has three isotopes, magnesium-24, magnesium-25, and magnesium-26. Which isotope is more naturally abundant than the others?

A) Magnesium-26

B) Magnesium-25

C) Magnesium-24

D) All are naturally abundant by equal percentages.

(162 Final, Q3)

16.2 Masses of Atoms

- From periodic table, $^{24.31}_{12}Mg$
- 24.31 = atomic mass (average) of all Magnesium isotopes
- Suppose all 3 isotopes have exactly same abundance ($\frac{1}{3}$ each):

$$24 \times \frac{1}{3} + 25 \times \frac{1}{3} + 26 \times \frac{1}{3} = 25$$

- Hence, To make the average closer to 24.31, The abundance of magnesium-24 must obviously be the greatest.

16.2 Masses of Atoms

13. Neon consists of three naturally occurring isotopes: $^{20}_{10}Ne$, $^{21}_{10}Ne$ and $^{22}_{10}Ne$. Which isotope of neon is likely to be the most prevalent (abundant)?

A) $^{20}_{10}Ne$

B) $^{21}_{10}Ne$

C) $^{22}_{10}Ne$

D) The prevalence is the same for all.

(171 Major 2, Q18)

16.2 Masses of Atoms

13. Neon consists of three naturally occurring isotopes: $^{20}_{10}Ne$, $^{21}_{10}Ne$ and $^{22}_{10}Ne$. Which isotope of neon is likely to be the most prevalent (abundant)?

A) $^{20}_{10}Ne$

B) $^{21}_{10}Ne$

C) $^{22}_{10}Ne$

D) The prevalence is the same for all.

(171 Major 2, Q18)

16.2 Masses of Atoms

- From periodic table, $^{20.18}_{10}\text{Ne}$
- 20.18 = atomic mass (average) of all neon isotopes
- Suppose all 3 isotopes have exactly same abundance ($\frac{1}{3}$ each = 33.33%):

$$20 \text{ x } \frac{1}{3} + 21 \text{ x } \frac{1}{3} + 22 \text{ x } \frac{1}{3} = 22$$

- Hence, to make the average closer to 20.18, The abundance of neon-20 must obviously be the greatest.

16.2 Masses of Atoms

14. Strontium (Sr) has four stable, naturally occurring isotopes: Sr-84, Sr-86, Sr-87, and Sr-88. Which isotope is most abundant in a sample of strontium?

A) Sr-84.

B) Sr-86.

C) Sr-87.

D) Sr-88.

E) Their abundances are equal.

(142 Major 2, Q17)

16.2 Masses of Atoms

14. Strontium (Sr) has four stable, naturally occurring isotopes: Sr-84, Sr-86, Sr-87, and Sr-88. Which isotope is most abundant in a sample of strontium?

A) Sr-84.

B) Sr-86.

C) Sr-87.

D) Sr-88.

E) Their abundances are equal.

(142 Major 2, Q17)

16.2 Masses of Atoms

- From periodic table, $^{87.62}_{38}\text{Sr}$
- 87.62 = atomic mass (average) of all strontium isotopes
- Suppose all 4 isotopes have exactly same abundance ($\frac{1}{4}$ each):

$$84 \text{ x } \frac{1}{4} + 86 \text{ x } \frac{1}{4} + 87 \text{ x } \frac{1}{4} + 88 \text{ x } \frac{1}{4} = 86.25$$

- Hence, to make the average closer to 87.62, The abundance of strontium-88 must obviously be the greatest. Don't be confused between 87 and 88. If 87 is the most abundant, then the average mass will be close to 87. We need to make it close to 88 (87.62 to be exact), which will only happen if 88 is the most abundant.

16.2 Masses of Atoms

15. An element is found in another galaxy exists as two isotopes. If 80% of the atoms have an atomic mass of 80.00 amu and the other 20% have an atomic mass 82.00 amu, what is the approximate atomic mass of the element?

A) 80.4 amu

B) 64.0 amu

C) 81.0 amu

D) 81.6 amu

(161 Major 2, Q19)

16.2 Masses of Atoms

15. An element is found in another galaxy exists as two isotopes. If 80% of the atoms have an atomic mass of 80.00 amu and the other 20% have an atomic mass 82.00 amu, what is the approximate atomic mass of the element?

A) 80.4 amu

B) 64.0 amu

C) 81.0 amu

D) 81.6 amu

(161 Major 2, Q19)

16.2 Masses of Atoms

$$\text{Avergae atomic mass} = 80 \text{ x } \frac{80}{100} + 82 \text{ x } \frac{20}{100}$$

$$= 80.4$$

16.2 Masses of Atoms

16. Carbon-12 has a mass of 12.0000 amu and makes up 98.89 % of naturally occurring carbon. Carbon-13 has a mass of 13.0034 amu and makes up 1.11 % of naturally occurring carbon. What is the average atomic mass of carbon?

A) 13.0000amu

B) 12.0111 amu

C) 12.5017 amu

D) 1201.11 amu.

(151 Major 2, Q16)

16.2 Masses of Atoms

16. Carbon-12 has a mass of 12.0000 amu and makes up 98.89 % of naturally occurring carbon. Carbon-13 has a mass of 13.0034 amu and makes up 1.11 % of naturally occurring carbon. What is the average atomic mass of carbon?

A) 13.0000amu

B) 12.0111 amu

C) 12.5017 amu

D) 1201.11 amu.

(151 Major 2, Q16)

16.2 Masses of Atoms

$$\text{Average atomic mass} = 12 \times \frac{98.99}{100}\ \text{amu} + 13 \times \frac{1.11}{100}\ \text{amu}$$

$$= 12.0111\ \text{amu}$$

16.3 The Periodic Table

16.3 The Periodic Table

1. The electron dot diagram for aluminum (Al) is

A) 

B) 

C) 

D) 

(171 Major 2, Q19)

16.3 The Periodic Table

1. The electron dot diagram for aluminum (Al) is

A) 

B) 

C) 

D) 

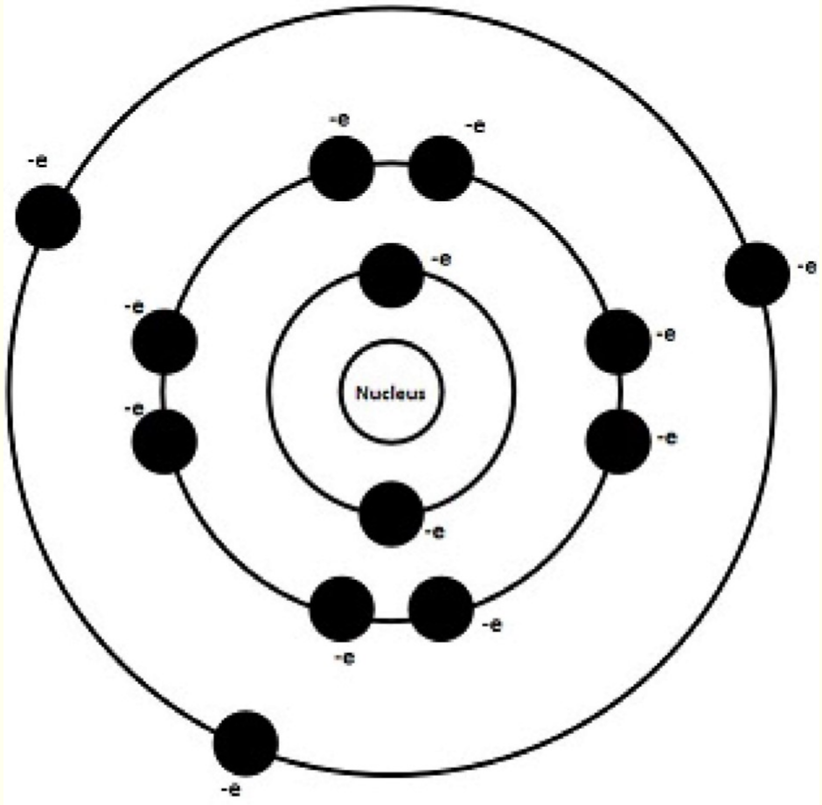
(171 Major 2, Q19)

16.3 The Periodic Table

Al is in group 13 , so it has 3 valence electrons. Only (A) has 3 valence electrons.

16.3 The Periodic Table

2. The distribution of electrons in their energy levels for an element is shown in the figure below. What is the name of this element?



A) Gallium

B) Boron

C) Aluminum

D) Silicon

(161 Final, Q20)

16.3 The Periodic Table

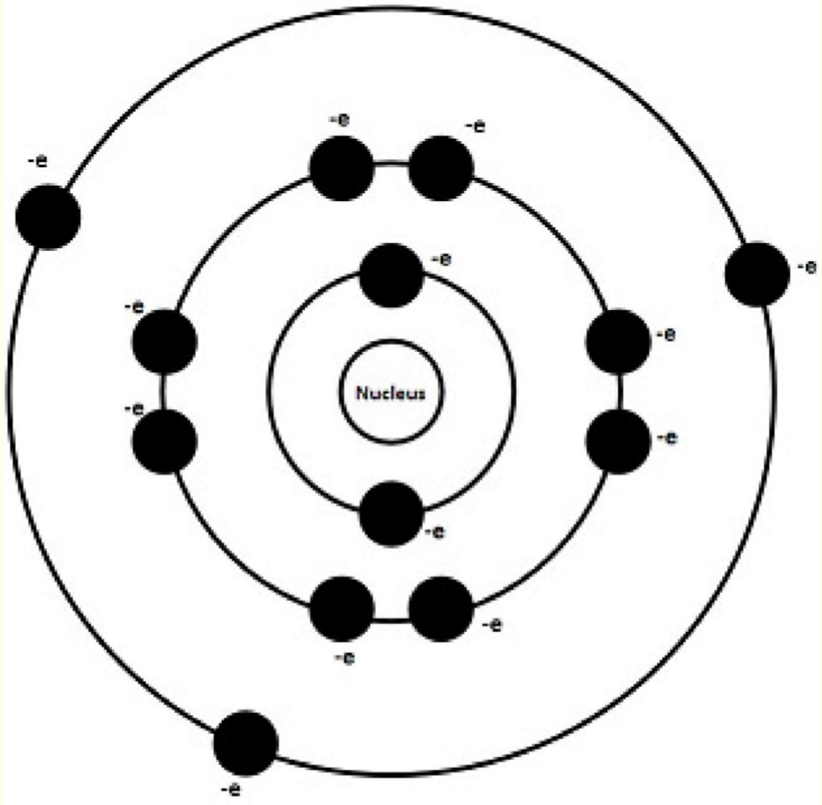
2. The distribution of electrons in their energy levels for an element is shown in the figure below. What is the name of this element?

A) Gallium

B) Boron

C) Aluminum

D) Silicon



(161 Final, Q20)

16.3 The Periodic Table

It has 13 electrons (just count) and thus 13 protons

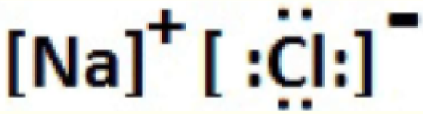
Because it is an element so it must be neutral.

So electrons = protons. The only element with 13 protons:

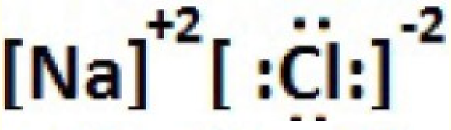
Aluminum (Al)

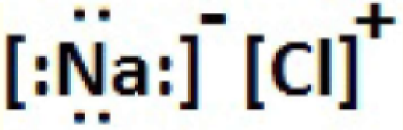
16.3 The Periodic Table

3. Which of the following is the correct electron dot diagram for sodium chloride (NaCl)?

A) 

B) 

C) 

D) 

(161 Major 2, Q20)

16.3 The Periodic Table

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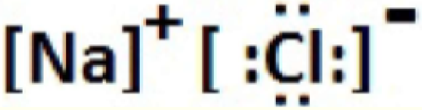
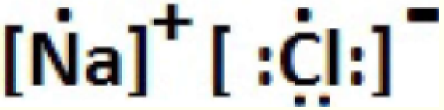
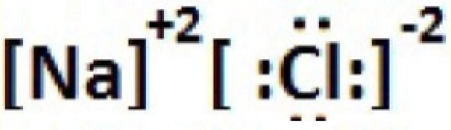
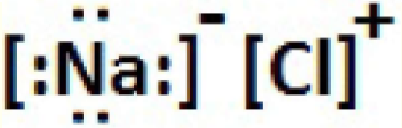
A) 

B) 

C) 

D) 

(161 Major 2, Q20)

16.3 The Periodic Table

- Na Is in group 1, so it has 1 valence electron. It will give away 1electron to achieve stable structure. after giving 1 electron, it has 1 more Proton than electron, so charge is +1
- Cl Is in group 17, so it has 7 valence electron. It will accept 1 electron to achieve stable structure. after accepting 1 electron, it has 1 more electron than Proton, so charge is -1.
- So C and D are wrong because they have the wrong charges.
- After The electron transfer take place, both Sodium and chlorine have full octet structure (8 electrons in outer shell), so B is wrong.
- So, only A is correct.

16.3 The Periodic Table

4. Which of the following elements is represented by the following electron dot diagram?

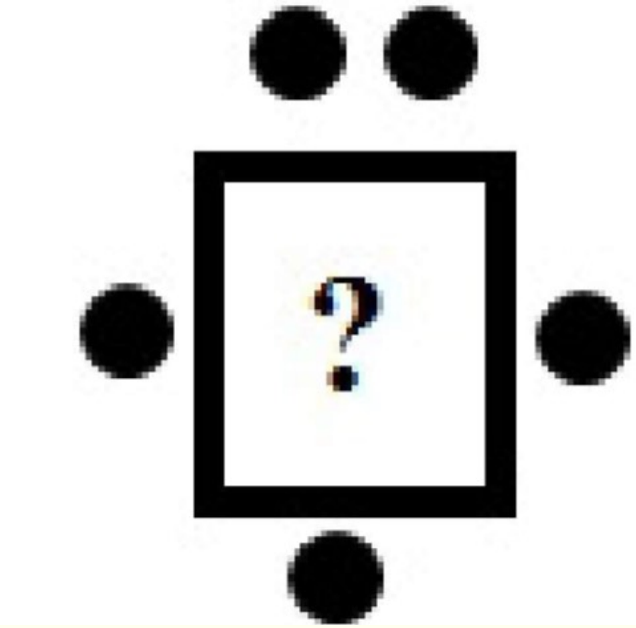
A) Aluminum (Al).

B) Sulfur (S).

C) Fluorine (F).

D) Antimony (Sb).

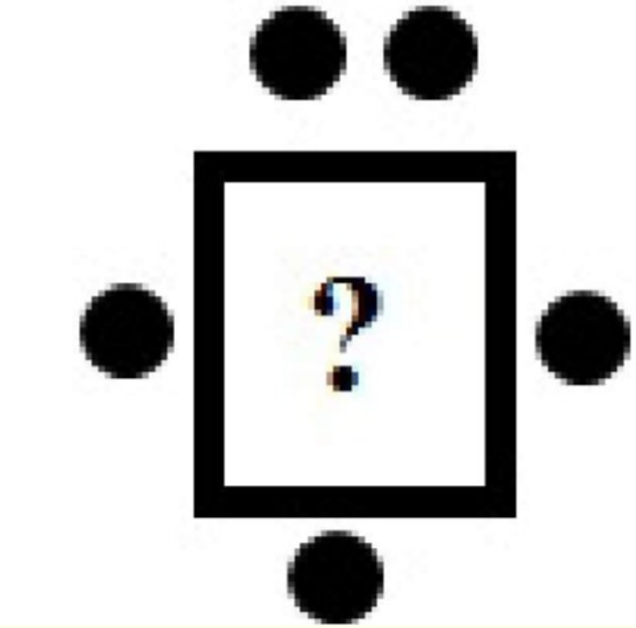
E) Sodium (Na).



(142 Major 2, Q18)

16.3 The Periodic Table

4. Which of the following elements is represented by the following electron dot diagram?



A) Aluminum (Al).

B) Sulfur (S).

C) Fluorine (F).

D) Antimony (Sb).

E) Sodium (Na).

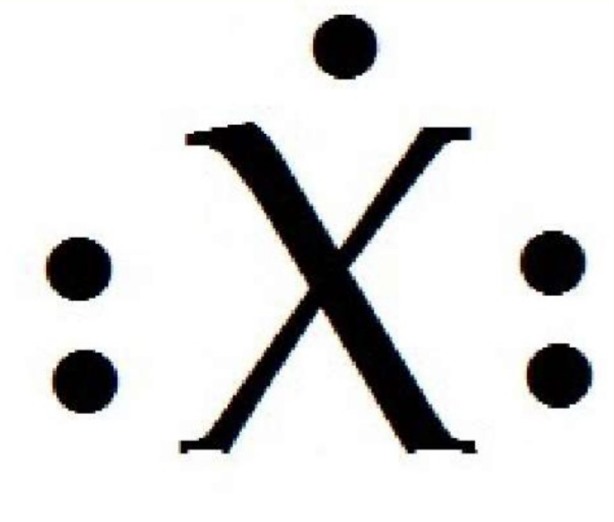
(142 Major 2, Q18)

16.3 The Periodic Table

- It has 5 Valence Electrons. so it must be in group 15.
- Only antimony (Sb) is in group 15

16.3 The Periodic Table

5. For which element does "X" stand for in the following electron dot diagram?



A) Phosphorus (P).

B) Oxygen (O).

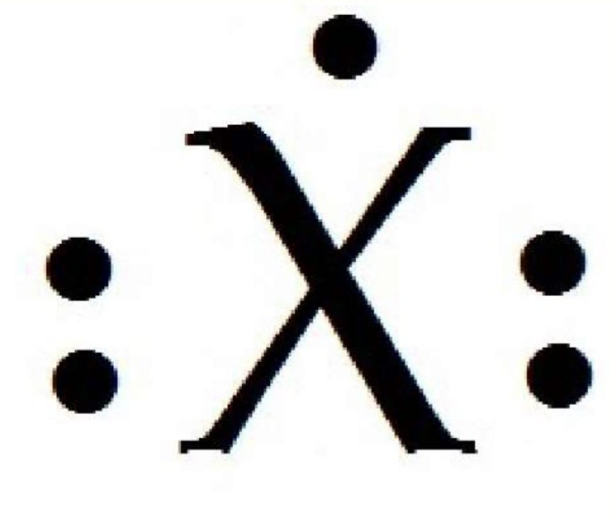
C) Boron (B).

D) Carbon (C).

(152 Major 2, Q20)

16.3 The Periodic Table

5. For which element does “X” stand for in the following electron dot diagram?



A) Phosphorus (P).

B) Oxygen (O).

C) Boron (B).

D) Carbon (C).

(152 Major 2, Q20)

16.3 The Periodic Table

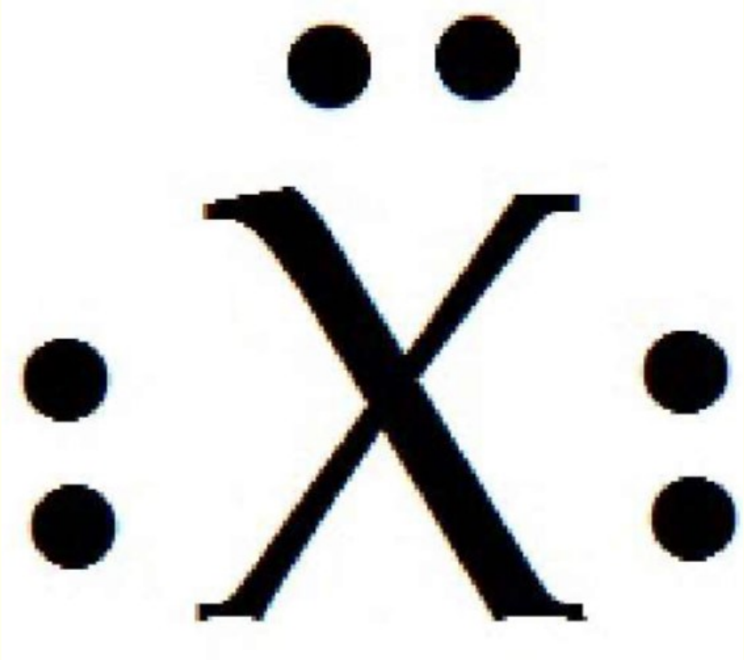
6. For which element does "X" stand for in the following electron dot diagram?

A) Oxygen

B) Nitrogen

C) Neon

D) Carbon



(151 Major 2, Q19)

16.3 The Periodic Table

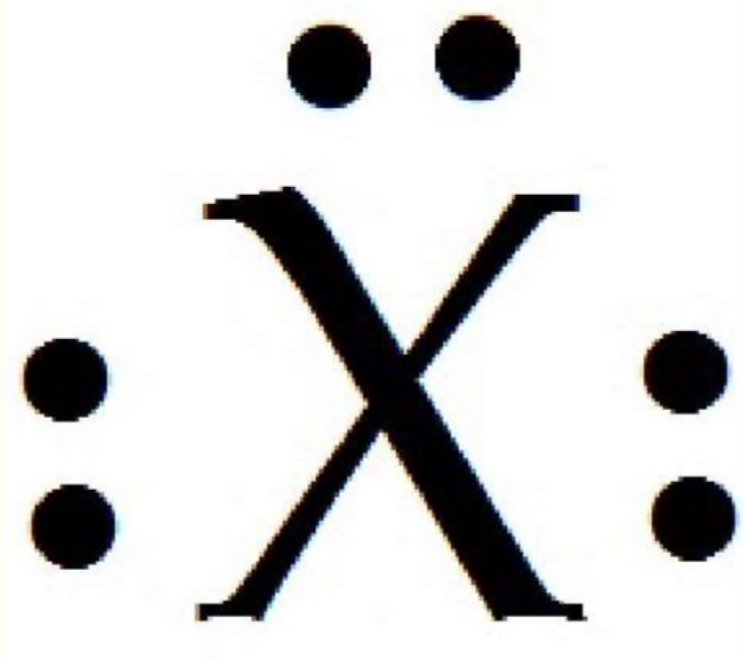
6. For which element does "X" stand for in the following electron dot diagram?

A) Oxygen

B) Nitrogen

C) Neon

D) Carbon



(151 Major 2, Q19)

16.3 The Periodic Table

7. Consider an ion with the symbol Y^{3-}. If Y is in period number 3 in the periodic table, what is this element?

A) Aluminum (Al).

B) Chlorine (Cl).

C) Phosphorus (P).

D) Silicon (Si).

(171 Major 2, Q20)

16.3 The Periodic Table

7. Consider an ion with the symbol Y^{3-}. If Y is in period number 3 in the periodic table, what is this element?

A) Aluminum (Al).

B) Chlorine (Cl).

C) Phosphorus (P).

D) Silicon (Si).

(171 Major 2, Q20)

16.3 The Periodic Table

Y^{3-} : 3- means it gains 3 electrons that's why it becomes -3
Elements in group 15 have 5 valence electrons so they must gain 3 to become stable octet structure. So it's in group 15.

period number 3 = 3rd row (Na to Ar)

The only element in group 15 and period 3 is:

Phosphorus (P)

16.3 The Periodic Table

8. Which element has properties that are similar to helium (He)?

A) Hydrogen (H).

B) Fluorine (F).

C) Nitrogen (N).

D) None of these.

(151 Major 2, Q18)

16.3 The Periodic Table

8. Which element has properties that are similar to helium (He)?

A) Hydrogen (H).

B) Fluorine (F).

C) Nitrogen (N).

D) None of these.

(151 Major 2, Q18)

16.3 The Periodic Table

Helium (He) is in group 18. Check the periodic table for group numbers of other elements. Same group = similar properties.

Elements	Group
Hydrogen	1
Fluorine	17
Nitrogen	15

So answer is... D) None of these.

16.3 The Periodic Table

9. Which of the following elements has properties that are similar to Calcium?

A) Potassium.

B) Scandium.

C) Lithium.

D) Beryllium.

E) Cesium.

(142 Major 2, Q15)

16.3 The Periodic Table

9. Which of the following elements has properties that are similar to Calcium?

A) Potassium.

B) Scandium.

C) Lithium.

D) Beryllium.

E) Cesium.

(142 Major 2, Q15)

16.3 The Periodic Table

Calcium (Ca) is in group 2. Check the periodic table for group numbers of other elements. Same group = similar properties.

Elements	Group
Potassium	1
Scandium	3
Lithium	1
Beryllium	2
Cesium	1

16.3 The Periodic Table

10. Which of the following elements has properties that are similar to Beryllium (Be)?

A) Scandium.

B) Lithium.

C) Calcium.

D) Potassium.

(161 Major 2, Q18)

16.3 The Periodic Table

10. Which of the following elements has properties that are similar to Beryllium (Be)?

A) Scandium.

B) Lithium.

C) Calcium.

D) Potassium.

(161 Major 2, Q18)

16.3 The Periodic Table

Beryllium (Be) is in group 2. Check the periodic table for group numbers of other elements. Same group = similar properties.

Elements	Group
Scandium	3
Lithium	1
Calcium	2
Potassium	1

16.3 The Periodic Table

11. Which of the following elements has properties that are similar to xenon (Xe)?

A) Iodine (I).

B) Helium (He).

C) Radium (Ra).

D) Germanium (Ge).

(162 Final, Q4)

16.3 The Periodic Table

11. Which of the following elements has properties that are similar to xenon (Xe)?

A) Iodine (I).

B) Helium (He).

C) Radium (Ra).

D) Germanium (Ge).

(162 Final, Q4)

16.3 The Periodic Table

xenon (Xe) is in group 18. Check the periodic table for group numbers of other elements. Same group = similar properties.

Elements	Group
Iodine	17
Helium	18
Radium	2
Germanium	14

16.3 The Periodic Table

12. Which element has properties that are similar to cupper (Cu)?

A) Silver (Ag).

B) Nickel (Ni).

C) Zinc (Zn).

D) Platinum (Pt).

(152 Major 2, Q19)

16.3 The Periodic Table

12. Which element has properties that are similar to cupper (Cu)?

A) Silver (Ag).

B) Nickel (Ni).

C) Zinc (Zn).

D) Platinum (Pt).

(152 Major 2, Q19)

16.3 The Periodic Table

Copper (Cu) is in group 11. Check the periodic table for group numbers of other elements. Same group = similar properties.

Elements	Group
Silver	11
Nickel	10
Zinc	12
Platinum	10

16.3 The Periodic Table

13. What is the number of valence electrons in barium (Ba)?

A) 3

B) 1

C) 2

D) 4

(161 Final, Q19)

16.3 The Periodic Table

13. What is the number of valence electrons in barium (Ba)?

A) 3

B) 1

C) 2

D) 4

(161 Final, Q19)

16.3 The Periodic Table

Barium (Ba) is in group 2, so it has 2 valence electrons.

16.3 The Periodic Table

14. Which of the following elements has four valence electrons?

A) Aluminum (Al)

B) Oxygen (O)

C) Tin (Sn)

D) Helium (He)

(152 Final, Q18)

16.3 The Periodic Table

14. Which of the following elements has four valence electrons?

A) Aluminum (Al)

B) Oxygen (O)

C) Tin (Sn)

D) Helium (He)

(152 Final, Q18)

16.3 The Periodic Table

Check the periodic table for group numbers. Helium is the special case just be careful, it is in group 18 but only has 2 valence electrons.

Elements	Group	No of valence electron
Aluminum	13	3
Oxygen	16	6
Tin	14	4
Helium	18	2

16.3 The Periodic Table

15. Which of the following elements has four valence electrons?

A) Silicon (Si).

B) Aluminum (Al).

C) Phosphorus (P).

D) Sulfur (S).

E) Calcium (Ca).

(142 Final, Q30)

16.3 The Periodic Table

15. Which of the following elements has four valence electrons?

A) Silicon (Si).

B) Aluminum (Al).

C) Phosphorus (P).

D) Sulfur (S).

E) Calcium (Ca).

(142 Final, Q30)

16.3 The Periodic Table

Check the periodic table for group numbers:

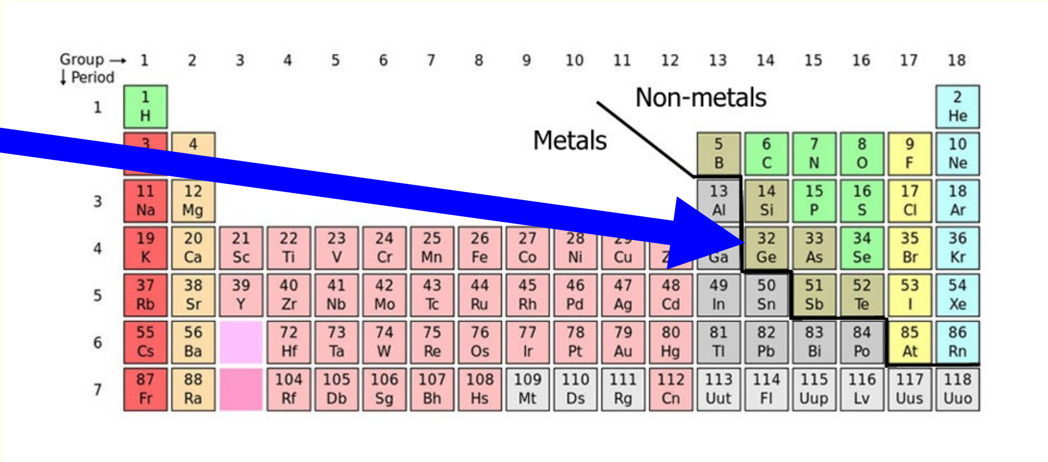
Elements	Group	No of valence electron
Silicon	14	4
Aluminum	13	3
Phosphorus	15	5
Sulfur	16	6
Calcium	2	2

18.1 Stability in Bonding

18.2 Types of Bonds

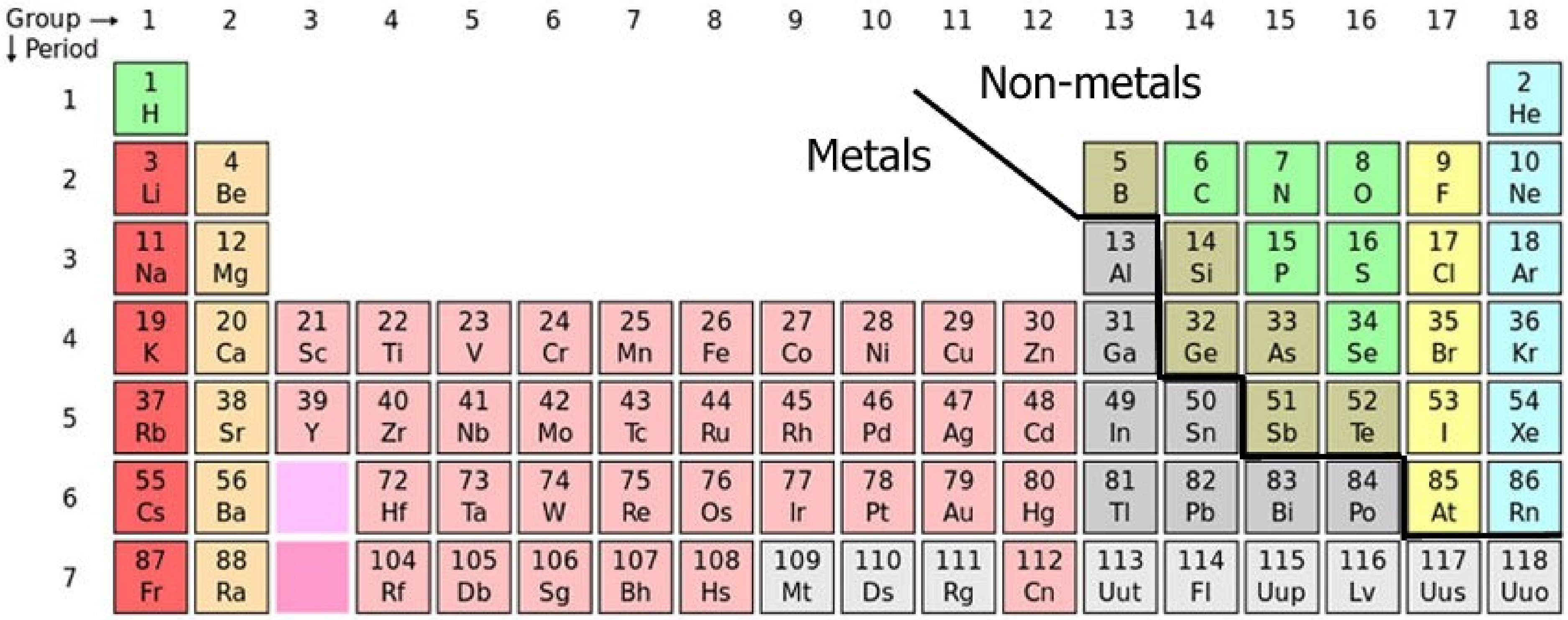
18.2 Types of Bonds

- Ionic Bonds are formed between metals and non-metals (to form ionic compounds)
- Covalent Bonds are formed between nonmetals (to form molecules)
- In short, metals are on left side and nonmetals are on right side of the periodic table
- Actually, there is a black dividing line that divides metals (left side) and nonmetals (right side)



- See next pg for bigger periodic table

18.2 Types of Bonds



18.2 Types of Bonds

1. Which of the following pairs of elements are likely to form an ionic compound?

A) Nitrogen and iodine.

B) Lithium and chlorine.

C) Oxygen and bromine.

D) Cesium and magnesium.

(171 Major 2, Q21)

18.2 Types of Bonds

1. Which of the following pairs of elements are likely to form an ionic compound?

A) Nitrogen and iodine.

B) Lithium and chlorine.

C) Oxygen and bromine.

D) Cesium and magnesium.

(171 Major 2, Q21)

18.2 Types of Bonds

1. Which of the following compounds has ionic bonds?

Ionic Bonds are formed between metals and non-metals (to form ionic compounds)

A) Nitrogen = nonmetal, iodine = nonmetal

B) Lithium = metal, chlorine = nonmetal

C) Oxygen = nonmetal, bromine = nonmetal

D) Cesium = metal, magnesium = metal

18.2 Types of Bonds

2. Which of the following compounds has ionic bonds?

A) Al_2O_3

B) CO_2

C) Cl_2

D) NH_3

E) O_3

(142 Final, Q21)

18.2 Types of Bonds

2. Which of the following compounds has ionic bonds?

A) Al_2O_3

B) CO_2

C) Cl_2

D) NH_3

E) O_3

(142 Final, Q21)

18.2 Types of Bonds

2. Which of the following compounds has ionic bonds?

Ionic Bonds are formed between metals and non-metals (to form ionic compounds)

A) Al = metal, O = nonmetal

B) C = nonmetal, O = nonmetal

C) Cl = nonmetal (Cl_2 is element, not compound)

D) N = nonmetal, H = nonmetal

E) O = nonmetal (O_3 is element, not compound)

18.2 Types of Bonds

3. Which of the following compounds is a molecule?

A) SO_2

B) $MgCl_2$

C) NaF

D) KI

(152 final, Q20)

18.2 Types of Bonds

3. Which of the following compounds is a molecule?

A) SO_2

B) $MgCl_2$

C) NaF

D) KI

(152 final, Q20)

18.2 Types of Bonds

Molecule means covalent bonds (i.e. nonmentals ONLY)

A) S = nonmetal, O = nonmetal

B) Mg = metal, Cl = nonmetal

C) Na = metal, F = nonmetal

D) K = metal, I = nonmetal

18.2 Types of Bonds

4. Which of the following compounds is a covalent compound?

A) KI

B) CO

C) $MgCl_2$

D) Li_3N

(162 Final, Q7)

18.2 Types of Bonds

4. Which of the following compounds is a covalent compound?

A) KI

B) CO

C) $MgCl_2$

D) Li_3N

(162 Final, Q7)

18.2 Types of Bonds

Molecule means covalent bonds (i.e. nonmentals ONLY)

A) K = metal, I = nonmetal

B) C = nonmetal, O = nonmetal

C) Mg = metal, Cl = nonmetal

D) Li = metal, N = nonmetal

18.2 Types of Bonds

5. Which of the following compounds is a covalent compound?

A) KI

B) NO_2

C) $MgCl_2$

D) Li_3N

(161 Final, Q1)

18.2 Types of Bonds

5. Which of the following compounds is a covalent compound?

A) KI

B) NO_2

C) $MgCl_2$

D) Li_3N

(161 Final, Q1)

18.2 Types of Bonds

Molecule means covalent bonds (i.e. nonmentals ONLY)

A) K = metal, I = nonmetal

B) N = nonmetal, O = nonmetal

C) Mg = metal, Cl = nonmetal

D) Li = metal, N = nonmetal

18.2 Types of Bonds

6. Which of the following molecules doesn't contain polar bonds?

A) S_8

B) CO

C) HCl

D) ICl

E) HF

(171 Final, Q19)

18.2 Types of Bonds

6. Which of the following molecules doesn't contain polar bonds?

A) S_8

B) CO

C) HCl

D) ICl

E) HF

(171 Final, Q19)

18.2 Types of Bonds

Now we give a detailed procedure to decide if a molecule is polar.

If <u>only 2 atoms</u> (diatomic), very easy, check if both atoms same or not?

Same = nonpolar, Different = polar:

If <u>more than 2 atoms</u> (polyatomic):

1. First see if there are any polar bonds? bonds are polar if the 2 atoms are different.

   e.g. Cl – Cl is NOT polar bond but Cl – C is polar bond.

2. If there are polar bonds, check if molecule is asymmetric (= not symmetric?

18.2 Types of Bonds

How to check if molecule is asymmetric?

1. **We need to check if molecule shape is symmetric or not?**
2. **If shape is symmetric, check if outer atoms (around central atom) are same or not?**

For 1. there are 3 symmetric & 2 asymmetric shapes

No lone pairs = symmetric shapes (linear, trigonal planar, tetrahedron)

Lone pairs present = asymmetric shapes (bent, trigonal pyramidal)

To understand this, look at next 2 examples:

18.2 Types of Bonds

The central atom is the one to which all the other atoms are bonded:

e.g. PCl_3 has 1 lone pair, so it is asymmetric but CCl_4 has no lone pair, so it is symmetric.

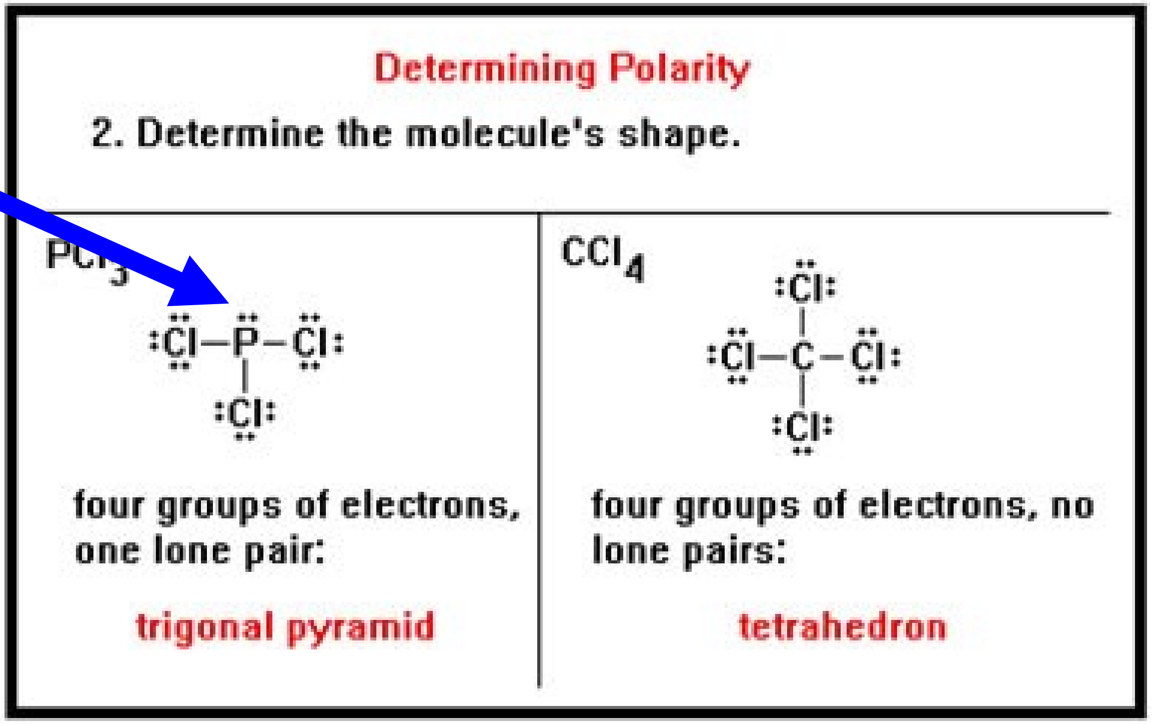
Lone pair = UNBONDED electrons

Asymmetric = polar molecule

Symmetric = check outer atoms?

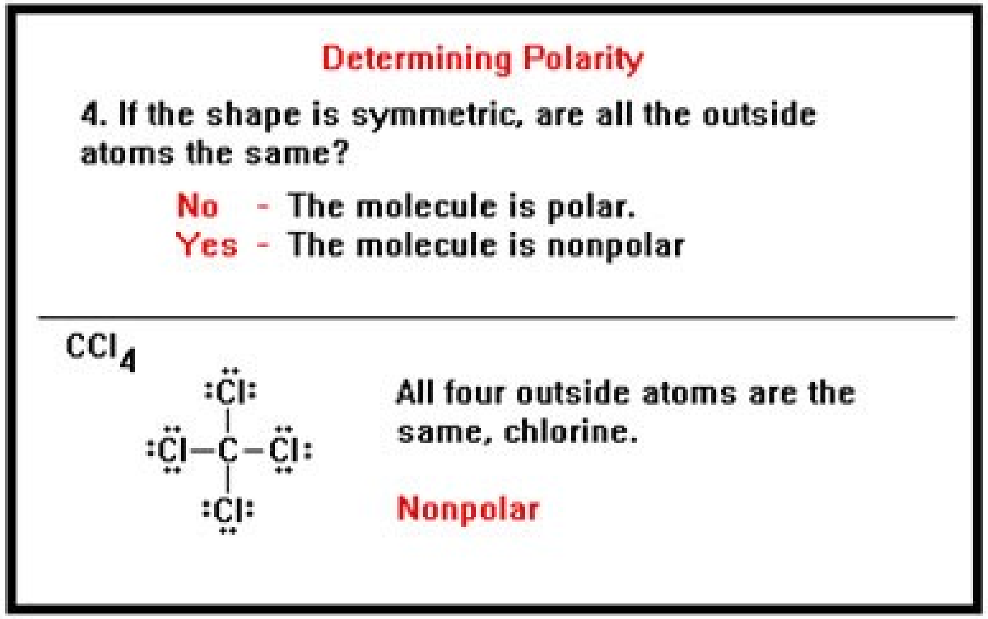
If same, molecule is nonpolar.

If different, molecule is polar.



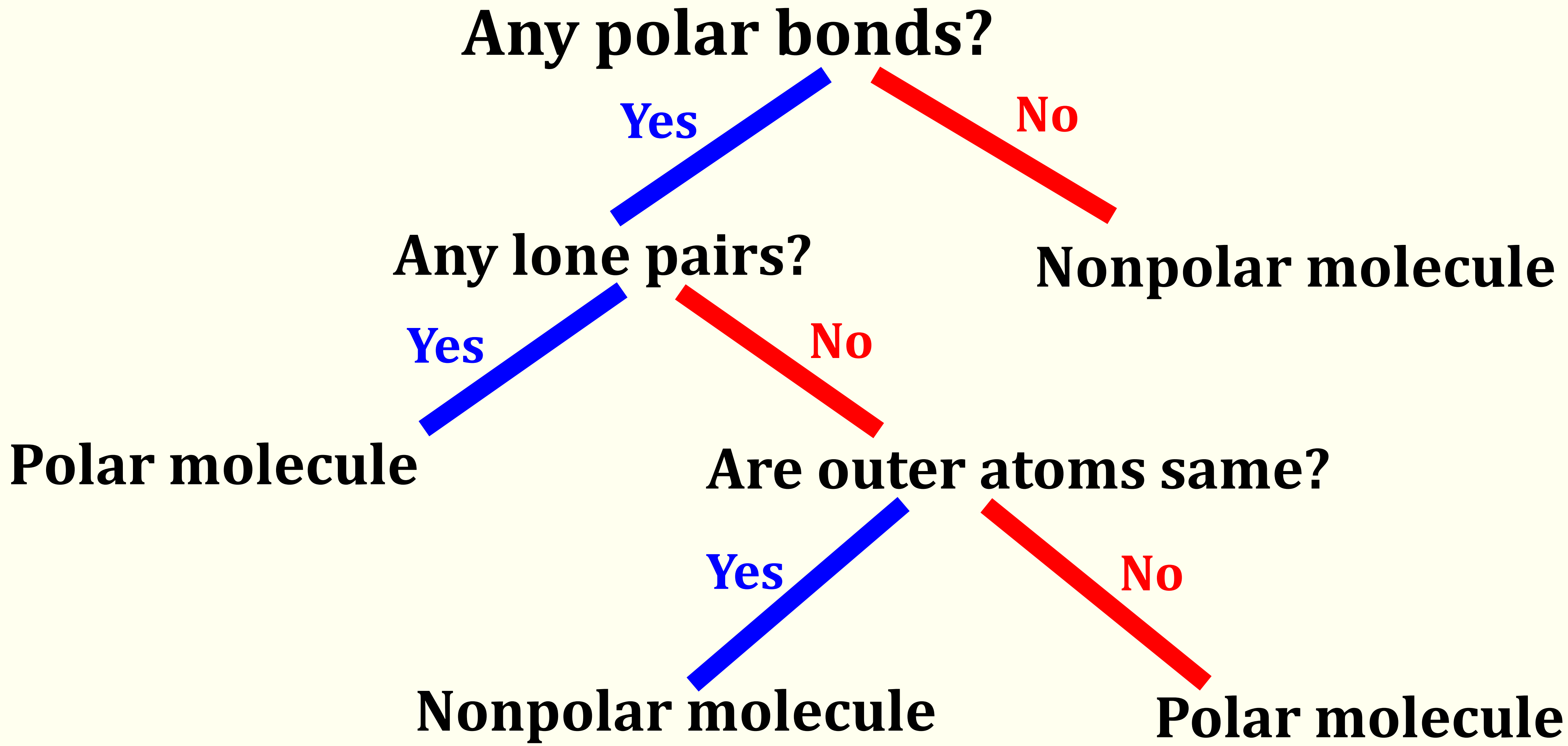
18.2 Types of Bonds

So CCl_4 is nonpolar because all atoms are same and shape is symmetric.



Now, we give a step-by-step method that summarises all the previous pages, to determine whether a polyatomic molecule (more than 2 atoms) is Polar or Nonpolar? Just follow the steps…

18.2 Types of Bonds



18.2 Types of Bonds

All these information has been extracted from these websites: please feel free to read through them to learn more interesting information. And you can also search yourself in Google "how to know if a molecule is Polar or not?"

http://dl.clackamas.edu/ch104/lesson9molecular_shapes.html

http://dl.clackamas.edu/ch104/lesson9molecular_polarity.html

In case you are wondering how this method works, it is based on the VSEPR theory, a simple theory in molecular chemistry.

VSEPR = Valence shell electron pair repulsion

18.2 Types of Bonds

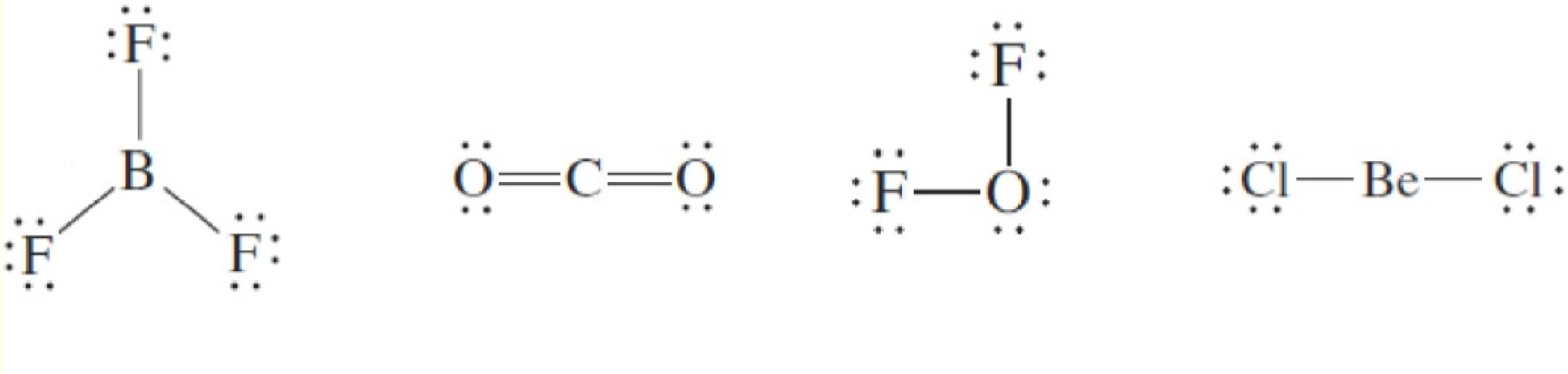
7. Which of the following compounds is a polar molecule?

A) CO_2

B) BF_3

C) $BeCl_2$

D) OF_2



BF_3 CO_2 OF_2 $BeCl_2$

(171 Major 2, Q23)

18.2 Types of Bonds

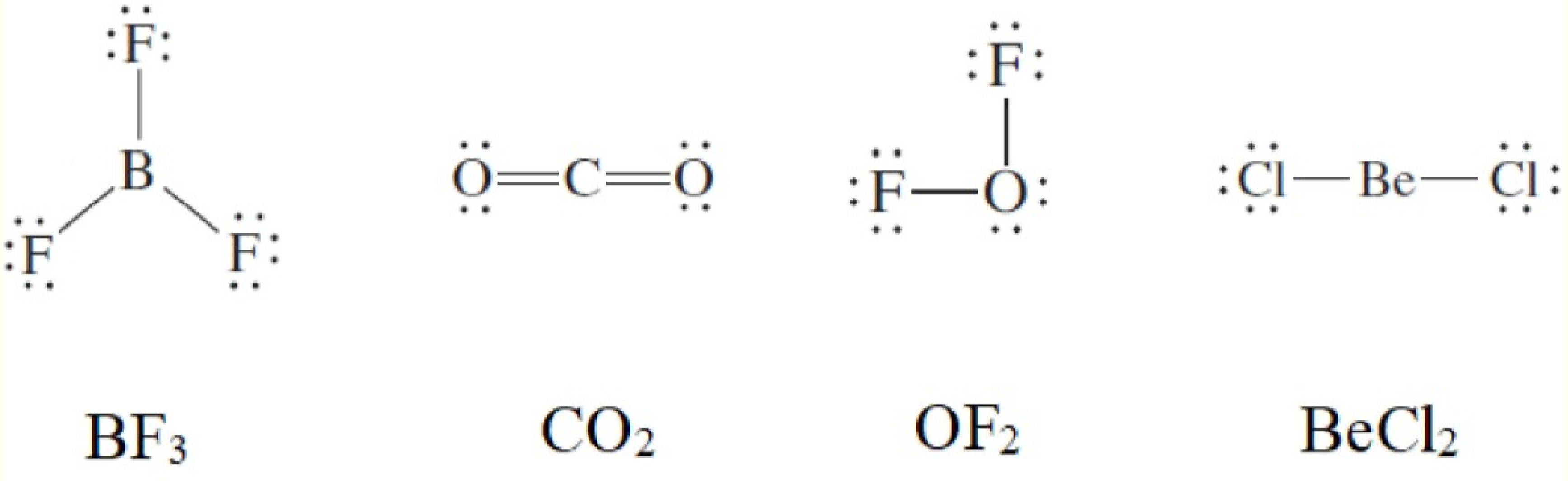
7. Which of the following compounds is a polar molecule?

A) CO_2

B) BF_3

C) $BeCl_2$

D) OF_2



(171 Major 2, Q23)

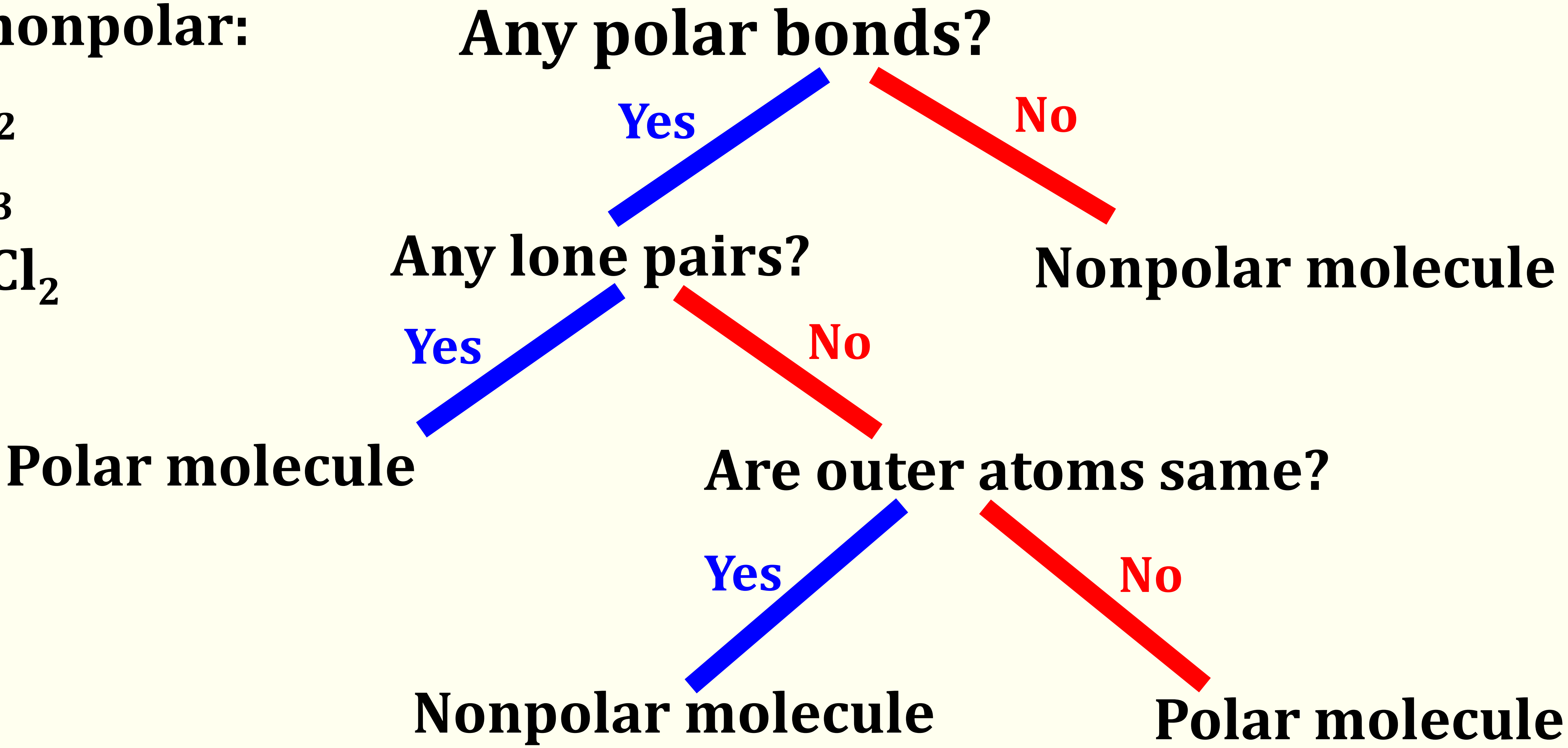
18.2 Types of Bonds

All 3 nonpolar:

A) CO_2

B) BF_3

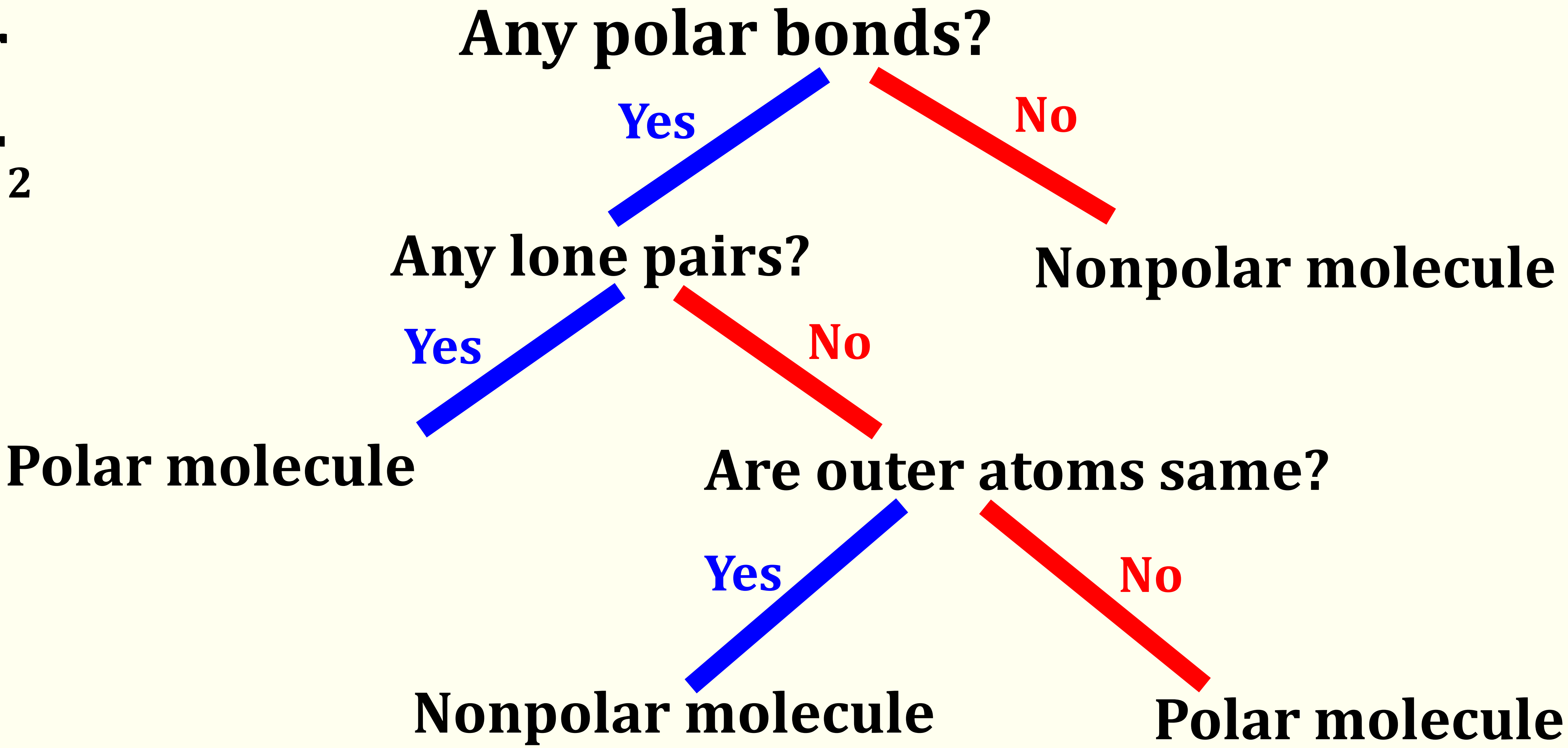
C) $BeCl_2$



18.2 Types of Bonds

Polar

D: OF_2



18.2 Types of Bonds

8. Which of the following compounds is a polar molecule?

A) $BeCl_2$

B) CCl_4

C) O_2

D) HCl

(162 Final, Q8)

18.2 Types of Bonds

8. Which of the following compounds is a polar molecule?

A) $BeCl_2$

B) CCl_4

C) O_2

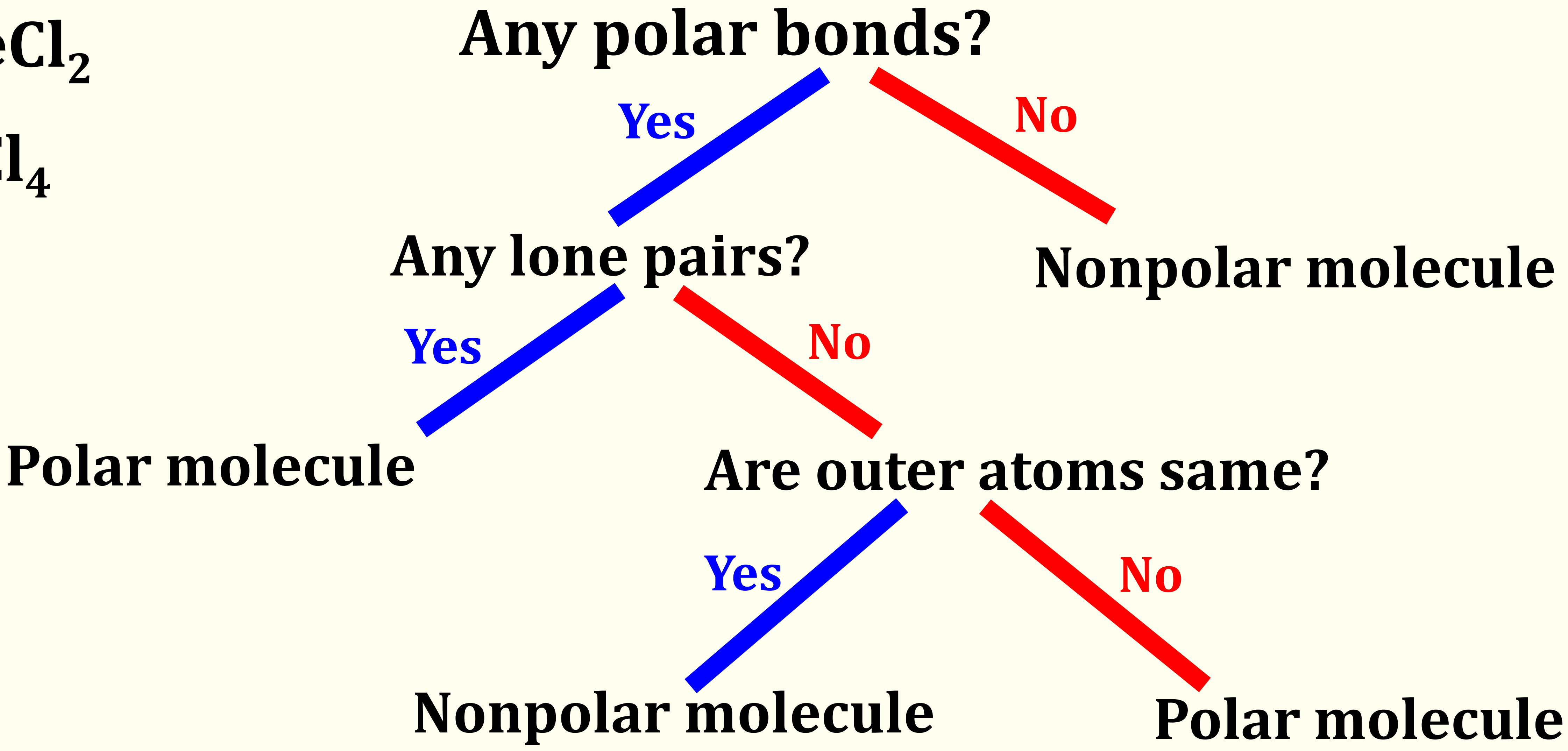
D) HCl

(162 Final, Q8)

18.2 Types of Bonds

A) $BeCl_2$

B) CCl_4



18.2 Types of Bonds

C) O_2 = diatomic, both Same atoms = nonpolar

D) HCl = diatomic, both Different atoms = polar

18.2 Types of Bonds

9. Which of the following compounds is a polar molecule?

A) HF

B) N_2

C) CCl_4

D) O_2

(161 Final, Q2)

18.2 Types of Bonds

9. Which of the following compounds is a polar molecule?

A) HF

B) N_2

C) CCl_4

D) O_2

(161 Final, Q2)

18.2 Types of Bonds

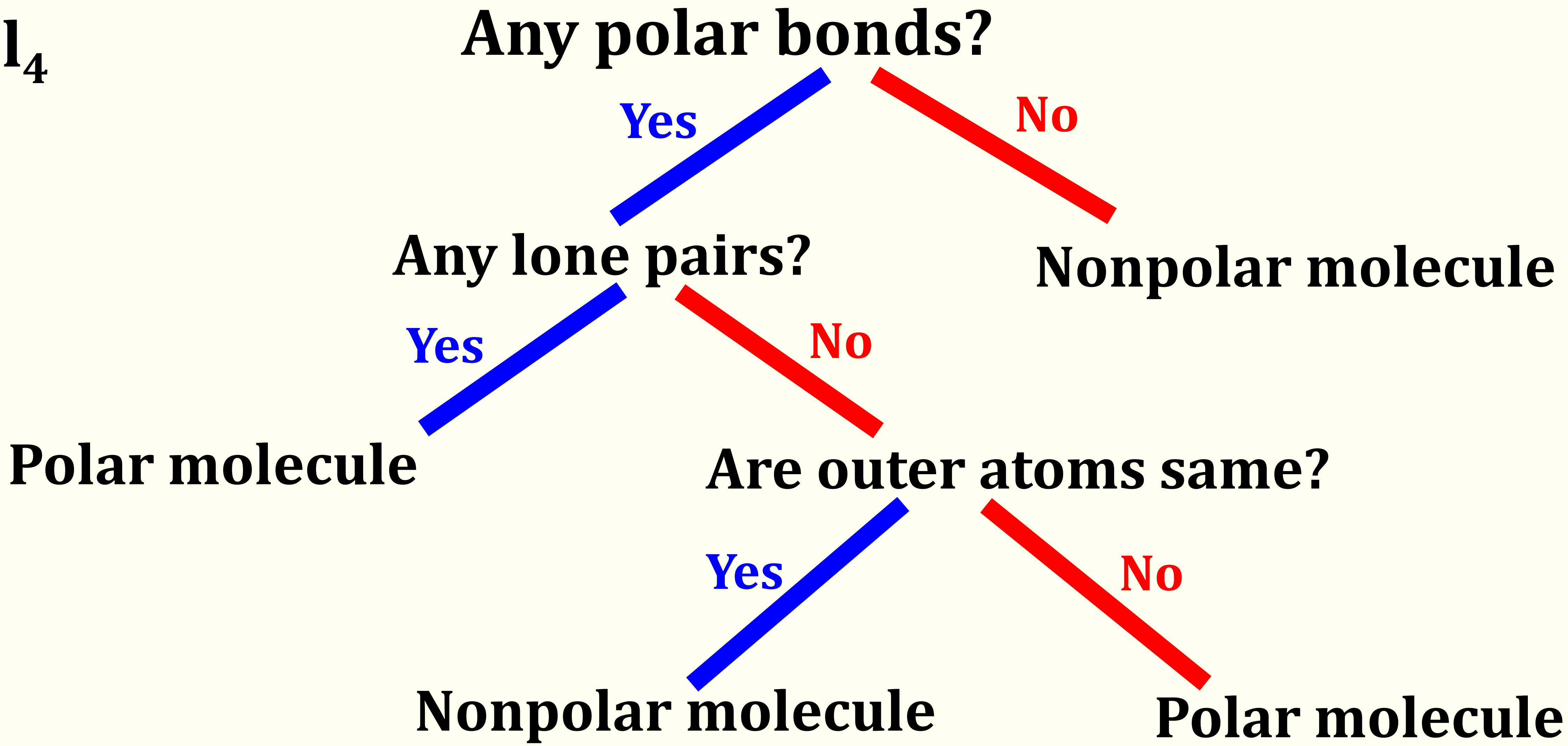
A) HF = diatomic, both Different atoms = polar molecule

B) N_2 = diatomic, both Same atoms = nonpolar molecule

D) O_2 = diatomic, both Same atoms = nonpolar molecule

18.2 Types of Bonds

C) CCl_4



18.2 Types of Bonds

10. Which of the following is a nonpolar molecule?

A) HCl

B) H_2O

C) $CHCl_3$

D) $BeCl_2$

(152 final, Q19)

18.2 Types of Bonds

10. Which of the following is a nonpolar molecule?

A) HCl

B) H_2O

C) $CHCl_3$

D) $BeCl_2$

(152 final, Q19)

18.2 Types of Bonds

A) HCl = diatomic, both Different atoms = polar molecule

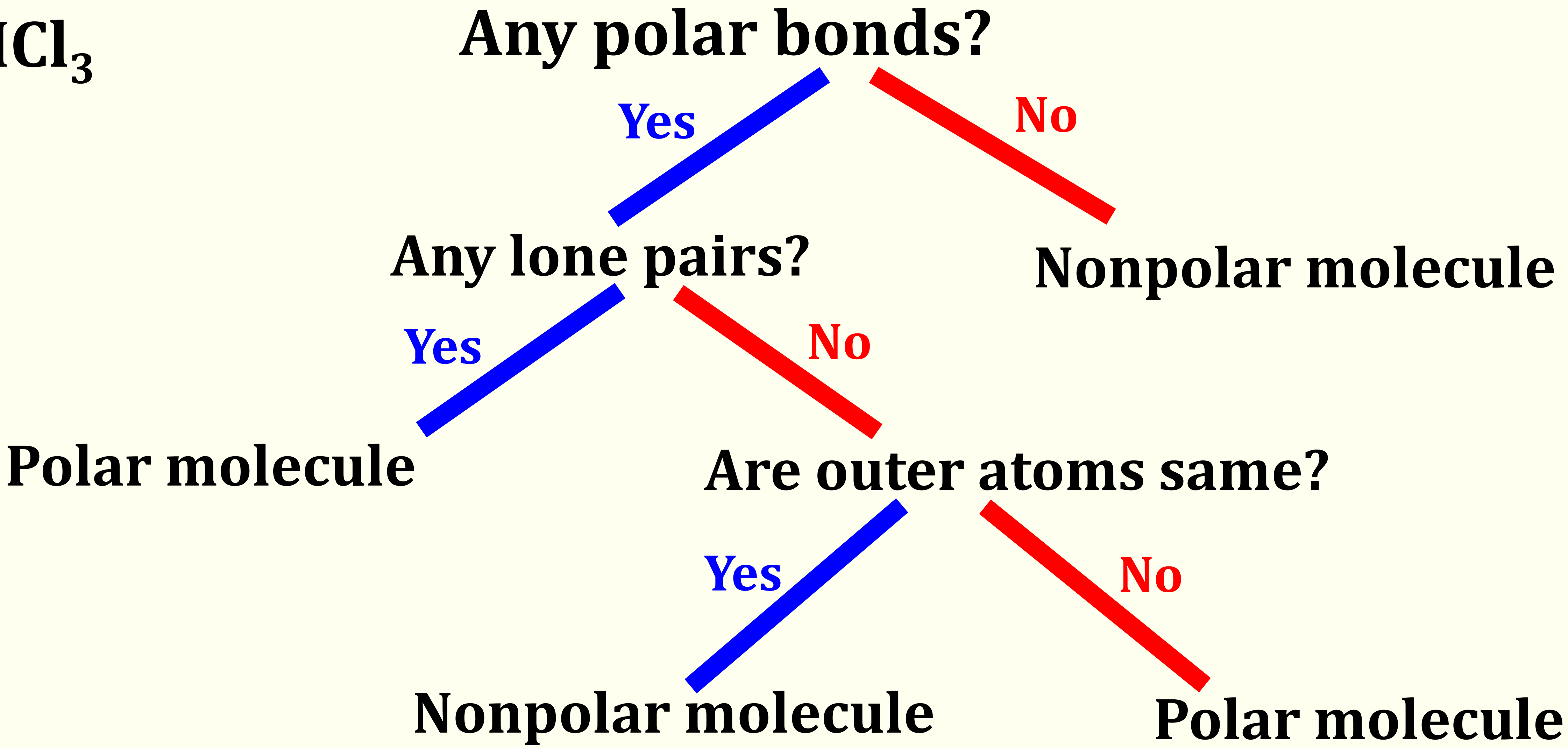
18.2 Types of Bonds

B) H_2O

Any polar bonds?
- Yes → Any lone pairs?
  - Yes → Polar molecule
  - No → Are outer atoms same?
    - Yes → Nonpolar molecule
    - No → Polar molecule
- No → Nonpolar molecule

18.2 Types of Bonds

C) $CHCl_3$



18.2 Types of Bonds

D) $BeCl_2$

- Any polar bonds?
  - Yes → Any lone pairs?
    - Yes → Polar molecule
    - No → Are outer atoms same?
      - Yes → Nonpolar molecule
      - No → Polar molecule
  - No → Nonpolar molecule

18.2 Types of Bonds

11. Which of the following is an example of a polar molecule?

A) CCl_4

B) $CHCl_3$

C) Cl_2

D) $BeCl_2$

(151 Final, Q10)

18.2 Types of Bonds

11. Which of the following is an example of a polar molecule?

A) CCl_4

B) $CHCl_3$

C) Cl_2

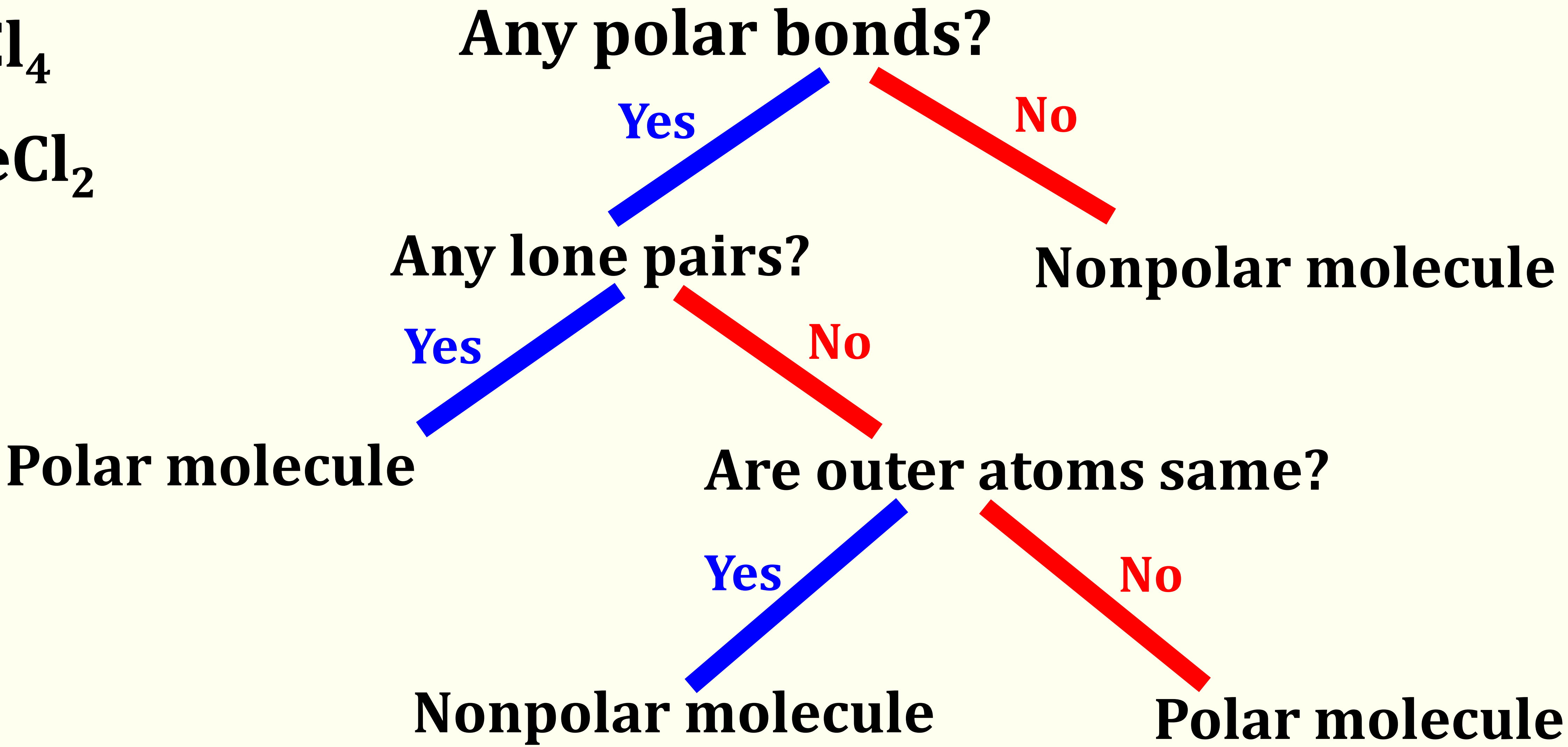
D) $BeCl_2$

(151 Final, Q10)

18.2 Types of Bonds

A) CCl_4

D) $BeCl_2$



18.2 Types of Bonds

B) $CHCl_3$

- **Any polar bonds?**
  - **Yes** → **Any lone pairs?**
    - **Yes** → **Polar molecule**
    - **No** → **Are outer atoms same?**
      - **Yes** → **Nonpolar molecule**
      - **No** → **Polar molecule**
  - **No** → **Nonpolar molecule**

18.2 Types of Bonds

C) Cl_2 = diatomic, both Same atoms = nonpolar molecule

18.2 Types of Bonds

12. Which atom(s) in the methane molecule (CH4) has a <u>partial negative charge</u> (δ-)?

A) Carbon atom.

B) Hydrogen atoms.

C) All of them.

D) None of them.

(151 Final, Q11)

18.2 Types of Bonds

12. Which atom(s) in the methane molecule (CH4) has a partial negative charge (δ-)?

A) Carbon atom.

B) Hydrogen atoms.

C) All of them.

D) None of them.

(151 Final, Q11)

18.2 Types of Bonds

Carbon has stronger electron pulling power (electronegativity) than hydrogen.

Electronegativity roughly depends on:

no. of proton – no. of non-valence (inner shell) electrons

Carbon: 6 – 4 = 2

Hydrogen: 1 – 0 = 1

18.2 Types of Bonds

So carbon is more electronegative than hydrogen, as it has stronger electron pulling power.

So, it has more electrons than protons near it, and will have more partial negative charge (δ-) than hydrogen.

18.2 Types of Bonds

13. Which of the following is an example of a polar molecule?

A) HBr

B) CCl_4

C) Cl_2

D) $BeCl_2$

(151 Major 2, Q20)

18.2 Types of Bonds

13. Which of the following is an example of a polar molecule?

A) HBr

B) CCl_4

C) Cl_2

D) $BeCl_2$

(151 Major 2, Q20)

18.2 Types of Bonds

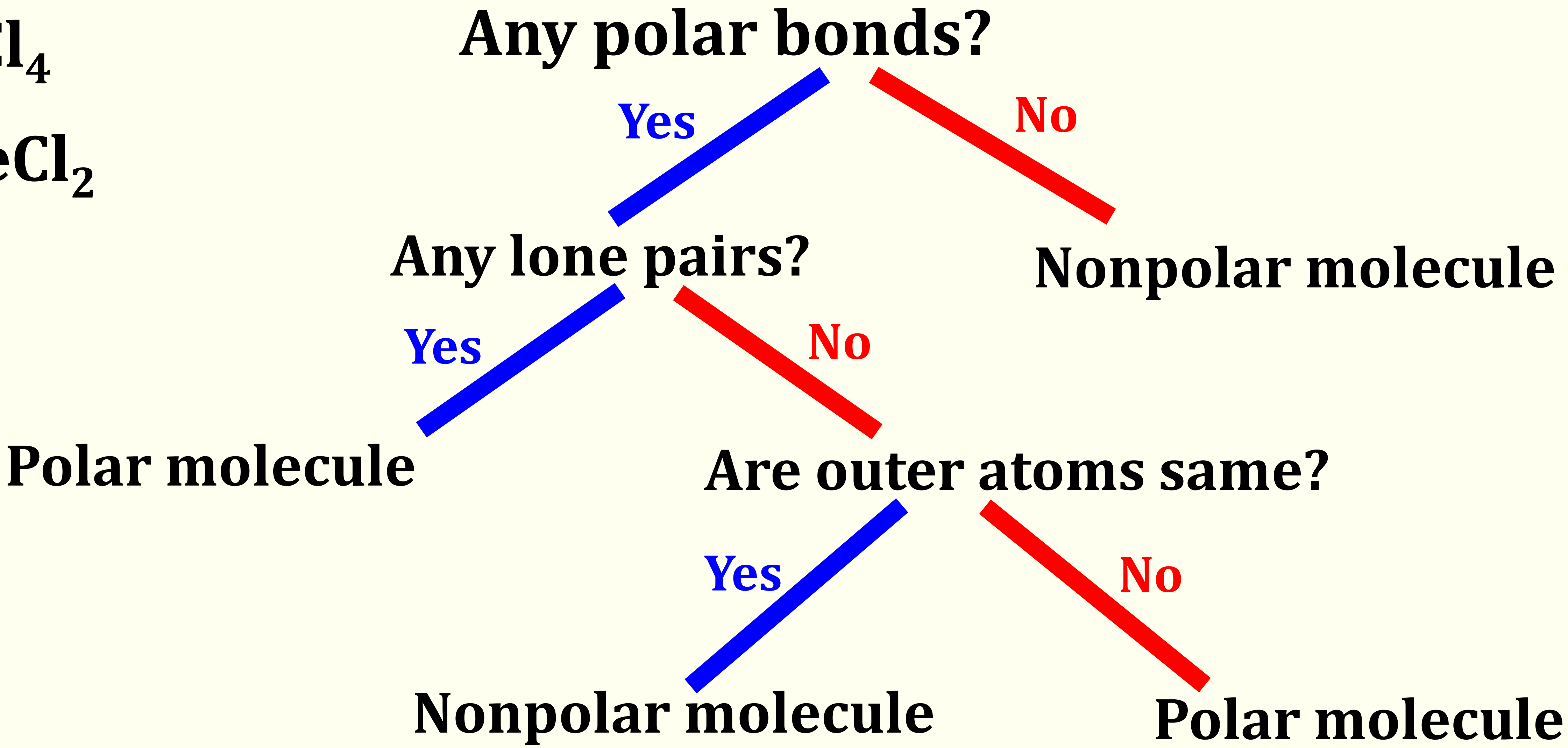
A) HBr = diatomic, both Different atoms = polar molecule

C) Cl_2 = diatomic, both Same atoms = nonpolar molecule

18.2 Types of Bonds

B) CCl_4

D) $BeCl_2$



18.2 Types of Bonds

14. Which of the following compounds is a nonpolar molecule?

A) CCl_4.

B) H_2O.

C) HCl.

D) $CHCl_3$.

E) HBr.

(142 Final, Q20)

18.2 Types of Bonds

14. Which of the following compounds is a nonpolar molecule?

A) CCl_4.

B) H_2O.

C) HCl.

D) $CHCl_3$.

E) HBr.

(142 Final, Q20)

18.2 Types of Bonds

Almost same as above questions!!!

18.3 Writing Formulas and Naming Compounds

18.3 Writing Formulas and Naming Compounds

- **The most important thing to know for this chapter is the prefix and Roman numbers.**

No.	Roman	Prefix
1	I	Mono-
2	II	Di-
3	III	Tri-
4	IV	Tetra-
5	V	Penta-
6	VI	Hexa-
7	VII	Hepta-
8	VIII	Octa-

18.3 Writing Formulas and Naming Compounds

- **Also, the number in brackets is the charge of that ion:**

E.g. chromium (III) means Cr^{3+}

It is always positive, and usually used for elements that can exist in multiple oxidation states (What is this???)

- **For e.g. chromium can exist as (II), (III) or (VI):**

oxidation states	Charge of Cr	E.g. of compounds	Name of compounds
(II)	+2	$CrCl_2$	chromium(II) chloride
(III)	+3	$Cr_2(CO_3)_3$	chromium(III) carbonate
(VI)	+6	$K_2Cr_2O_7$	Potassium dichromium(VI)

18.3 Writing Formulas and Naming Compounds

- **Overall, the <u>entire molecule or compound</u> must be <u>electrically neutral</u>**

E.g. $CaCO_3$ is made of Ca^{2+} and CO_3^{2-}

Total charge of entire $CaCO_3$ = (+2) + (-2) = 0

- **Returning to Chromium:**

E.g. chromium(II) chloride, $CrCl_2$ is made of Cr^{2+} and Cl^-

Total charge of entire $CaCO_3$ = (+2) + 2(-1) = 0

18.3 Writing Formulas and Naming Compounds

- **Overall, the <u>entire molecule or compound</u> must be <u>electrically neutral</u>**

E.g. $CaCO_3$ is made of Ca^{2+} and CO_3^{2-}

Total charge of entire $CaCO_3$ = (+2) + (-2) = 0

- **Returning to Chromium:**

E.g. chromium(II) chloride, $CrCl_2$ is made of Cr^{2+} and Cl^{-}

Total charge of entire $CaCO_3$ = (+2) + 2(-1) = 0 <u>(electrically neutral)</u>

18.3 Writing Formulas and Naming Compounds

- **Another chromium exmple:**

E.g. chromium (III) carbonate, $Cr_2(CO_3)_3$ is made of Cr^{3+} and CO_3^{2-}

Total charge of $Cr_2(CO_3)_3$ = 2(+3) + 3(-2) = 0 (<u>electrically neutral)</u>

- **Last chromium example:**

E.g. Potassium dichromium (VI), $K_2Cr_2O_7$ is made of K^+, Cr^{6+} and O^{2-}

Total charge of entire $K_2Cr_2O_7$ = 2(+1) + 2(+6) + 7(-2) = 0

(<u>electrically neutral)</u>

18.3 Writing Formulas and Naming Compounds

1. What is the chemical formula for chromium(III) carbonate?

A) $Cr_3(CO_3)_2$

B) Cr_2CO_3

C) $CrCO_3$

D) $Cr_2(CO_3)_3$

(171 Major 2, Q22)

18.3 Writing Formulas and Naming Compounds

1. What is the chemical formula for chromium(III) carbonate?

A) $Cr_3(CO_3)_2$

B) Cr_2CO_3

C) $CrCO_3$

D) $Cr_2(CO_3)_3$

(171 Major 2, Q22)

18.3 Writing Formulas and Naming Compounds

chromium (III) carbonate:

chromium (III) means Cr^{3+} and carbonate is always CO_3^{2-}

Total charge of chromium (III) carbonate must = 0 (electrically neutral)

So, find X and Y in $Cr_X(CO_3)_Y$:

The smallest ratio is: X = 2 and Y = 3, where we get:

$2(+3) + 3(-2) = 0$

Thus $Cr_2(CO_3)_3$

Of course, X = 4 & Y = 6 will also work but we only write chemical formula in the smallest whole number ratio

18.3 Writing Formulas and Naming Compounds

2. What is the chemical formula of dinitrogen trioxide?

A) NO_3.

B) N_2O_4.

C) N_2O_3.

D) N_3O.

(171 Major 2, Q24)

18.3 Writing Formulas and Naming Compounds

2. What is the chemical formula of dinitrogen trioxide?

A) NO_3.

B) N_2O_4.

C) N_2O_3.

D) N_3O.

(171 Major 2, Q24)

18.3 Writing Formulas and Naming Compounds

dinitrogen trioxide:

dinitrogen means N_2 and trioxide means O_3

Thus N_2O_3

18.3 Writing Formulas and Naming Compounds

3. What is the chemical formula for diphosphorus tetraiodide?

A) P_2I_3

B) P_4I_2

C) PI

D) P_2I_4

E) PI_4

(171 Final, Q17)

18.3 Writing Formulas and Naming Compounds

3. What is the chemical formula for diphosphorus tetraiodide?

A) P_2I_3

B) P_4I_2

C) PI

D) P_2I_4

E) PI_4

(171 Final, Q17)

18.3 Writing Formulas and Naming Compounds

diphosphorus tetraiodide:

diphosphorus means P_2 and tetraiodide means I_4

Thus P_2I_4

18.3 Writing Formulas and Naming Compounds

4. What is the chemical formula for the following compound: copper (II) sulfate pentahydrate?

A) $Cu_2SO_4.5H_2O$

B) $CuSO_3.H_2O$

C) $Cu(SO_4)_2.5H_2O$

D) $CuSO_4.5H_2O$

(162 Final, Q9)

18.3 Writing Formulas and Naming Compounds

4. What is the chemical formula for the following compound: copper (II) sulfate pentahydrate?

A) $Cu_2SO_4.5H_2O$

B) $CuSO_3.H_2O$

C) $Cu(SO_4)_2.5H_2O$

D) $CuSO_4.5H_2O$

(162 Final, Q9)

18.3 Writing Formulas and Naming Compounds

copper (II) sulfate:

copper (II) means Cu^{2+} and sulfate is always SO_4^{2-}

Total charge of copper (II) sulfate must = 0 (<u>electrically neutral)</u>

So, find X and Y in $Cr_X(SO4)_Y$:

The smallest ratio is: X = 1 and Y = 1, where we get:

$1(+2) + 1(-2) = 0$

Thus $CuSO_4$; now, add pentahydrate = $5H_2O$;

So, we get: $CuSO_4.5H_2O$

18.3 Writing Formulas and Naming Compounds

5. What is the formula for the compound that forms when ammonium ions (NH_4^+) and phosphate ions (PO_4^{-3}) combine?

A) $(NH_4)_3PO_4$

B) NH_4PO_4

C) $NH_{12}PO_4$

D) $NH_4(PO_4)_3$

(162 Final, Q15)

18.3 Writing Formulas and Naming Compounds

5. What is the formula for the compound that forms when ammonium ions (NH_4^+) and phosphate ions (PO_4^{-3}) combine?

A) $(NH_4)_3PO_4$

B) NH_4PO_4

C) $NH_{12}PO_4$

D) $NH_4(PO_4)_3$

(162 Final, Q15)

18.3 Writing Formulas and Naming Compounds

ammonium phosphate:

ammonium means NH_4^+ and phosphate is PO_4^{3-}

Total charge of ammonium phosphate must = 0 (electrically neutral)

So, find X and Y in $(NH_4)_X(PO_4)_Y$:

The smallest ratio is: X = 3 and Y = 1, where we get:

$3(+1) + 1(-3) = 0$

Thus $(NH_4)_3PO_4$

Of course, X = 6 & Y = 2 will also work but we only write chemical formula in the smallest whole number ratio

18.3 Writing Formulas and Naming Compounds

6. What is the chemical formula for the compound gold(III) nitride?

A) Au_3N

B) AuN_3

C) AuN

D) Au_3N_3

(161 Final, Q3)

18.3 Writing Formulas and Naming Compounds

6. What is the chemical formula for the compound gold(III) nitride?

A) Au_3N

B) AuN_3

C) AuN

D) Au_3N_3

(161 Final, Q3)

18.3 Writing Formulas and Naming Compounds

Gold (III) nitride:

Gold (III) means Au^{3+} and nitride is always N^{3-}

Total charge of gold (III) nitride must = 0 (electrically neutral)

So, find X and Y in $Au_X(N)_Y$:

The smallest ratio is: X = 1 and Y = 1, where we get:

$1(+3) + 1(-3) = 0$

So, we get Au_3N

18.3 Writing Formulas and Naming Compounds

7. What is the formula for the compound that forms between calcium (Ca) and phosphate (PO_4^{3-})?

A) $CaPO_4$

B) $Ca_2(PO_4)_3$

C) Ca_3PO_4

D) $Ca_3(PO_4)_2$

(161 Final, Q7)

18.3 Writing Formulas and Naming Compounds

7. What is the formula for the compound that forms between calcium (Ca) and phosphate (PO_4^{3-})?

A) $CaPO_4$

B) $Ca_2(PO_4)_3$

C) Ca_3PO_4

D) $Ca_3(PO_4)_2$

(161 Final, Q7)

18.3 Writing Formulas and Naming Compounds

calcium phosphate:

calcium is always Ca^{2+} and phosphate is PO_4^{3-}

Total charge of calcium phosphate must = 0 (electrically neutral)

So, find X and Y in $(Ca)_X(PO_4)_Y$:

The smallest ratio is: X = 3 and Y = 2, where we get:

$3(+2) + 2(-3) = 0$

Thus $Ca_3(PO_4)_2$

Of course, X = 6 & Y = 4 will also work but we only write chemical formula in the smallest whole number ratio

18.3 Writing Formulas and Naming Compounds

8. What is the name of the compound $Mg_3(PO_4)_2.4H_2O$?

A) trimagnesium diphosphate tetrahydrate.

B) magnesium phosphate tetrahydrate.

C) magnesium phosphide with water.

D) magnesium diphosphate hydrate

(171 Major 2, Q25)

18.3 Writing Formulas and Naming Compounds

8. What is the name of the compound $Mg_3(PO_4)_2.4H_2O$?

A) trimagnesium diphosphate tetrahydrate.

B) magnesium phosphate tetrahydrate.

C) magnesium phosphide with water.

D) magnesium diphosphate hydrate

(171 Major 2, Q25)

18.3 Writing Formulas and Naming Compounds

$Mg_3(PO_4)_2.4H_2O$ is made up Mg^{2+} and PO_4^{3-} and $4H_2O$

Mg^{2+} is magnesium and is PO_4^{3-} is phosphate

(no need tri- and di- as it is NOT a covalent compound)

Thus magnesium phosphate; now, add $4H_2O$ = tetrahydrate

So, we get: magnesium phosphate tetrahydrate

18.3 Writing Formulas and Naming Compounds

9. What is the chemical name for Fe_2S_3?

A) Iron (III) sulfide

B) Diiron trisulfide

C) Iron(II) sulfuride

D) Iron sulfate.

E) Iron(II) sulfide.

(171 Final, Q18)

18.3 Writing Formulas and Naming Compounds

9. What is the chemical name for Fe_2S_3?

A) Iron (III) sulfide

B) Diiron trisulfide

C) Iron(II) sulfuride

D) Iron sulfate.

E) Iron(II) sulfide.

(171 Final, Q18)

18.3 Writing Formulas and Naming Compounds

Fe_2S_3

S^{2-} (see p566 top) is sulphide (see p568 top)

Let the oxidation state of Fe be X:

By charge neutrality, $2(X) + 3(-2) = 0$

So, $X = +3$ i.e. Iron (III)

Ans.: Iron (III) sulfide

18.3 Writing Formulas and Naming Compounds

10. What is the name of the following compound: $PbCl_4$?

A) Lead (IV) chloride.

B) Lead chloride.

C) Lead (IV) tetrachloride.

D) Lead tetrachloride.

(162 Final, Q10)

18.3 Writing Formulas and Naming Compounds

10. What is the name of the following compound: $PbCl_4$?

A) Lead (IV) chloride.

B) Lead chloride.

C) Lead (IV) tetrachloride.

D) Lead tetrachloride.

(162 Final, Q10)

18.3 Writing Formulas and Naming Compounds

$PbCl_4$

Cl^- (see p566 top) is chloride (see p568 top)

Let the oxidation state of Pb be X:

By charge neutrality, 1(X) + 4(-1) = 0

So, X = +4 i.e. Lead (IV)

Ans.: Lead (IV) chloride

18.3 Writing Formulas and Naming Compounds

11. What is the name of the following compound: SF_6?

A) Sulfur (VI) fluoride.

B) Sulfur hexafluoride.

C) Sulfur fluoride.

D) Fluorine hexasulfide.

(162 Final, Q11)

18.3 Writing Formulas and Naming Compounds

11. What is the name of the following compound: SF_6?

A) Sulfur (VI) fluoride.

B) Sulfur hexafluoride.

C) Sulfur fluoride.

D) Fluorine hexasulfide.

(162 Final, Q11)

18.3 Writing Formulas and Naming Compounds

SF_6

First note this is a covalent compound

So the first part will have no suffix and second part will have suffix

S is sulfur (no suffix)

F_6 is hexafluoride (with suffix)

Ans.: sulfur hexafluoride

18.3 Writing Formulas and Naming Compounds

12. What is the name of the following compound: $CuSO_4.5H_2O$?

A) Copper sulfate pentahydrate

B) anhydrous copper sulfide

C) Copper (II) sulfate pentahydrate

D) Copper (II) sulfide tetrahydrate

(161 Final, Q4)

18.3 Writing Formulas and Naming Compounds

12. What is the name of the following compound: $CuSO_4.5H_2O$?

A) Copper sulfate pentahydrate

B) anhydrous copper sulfide

C) Copper (II) sulfate pentahydrate

D) Copper (II) sulfide tetrahydrate

(161 Final, Q4)

18.3 Writing Formulas and Naming Compounds

$CuSO_4.5H_2O$ is made up Cu^{2+} and SO_4^{2-} and $5H_2O$

Cu^{2+} is Copper (II) and SO_4^{2-} is sulphate

Thus Copper (II) sulphate; now, add $5H_2O$ = pentahydrate

So, we get: Copper (II) sulphate pentahydrate

13. What is the name of the following compound: N_2O_5?

A) dinitrogen tetroxide

B) nitrogen oxide

C) trinitrogen heptoxide

D) dinitrogen pentoxide

(161 Final, Q5)

18.3 Writing Formulas and Naming Compounds

13. What is the name of the following compound: N_2O_5?

A) dinitrogen tetroxide

B) nitrogen oxide

C) trinitrogen heptoxide

D) dinitrogen pentoxide

(161 Final, Q5)

18.3 Writing Formulas and Naming Compounds

N_2O_5:

dinitrogen means N_2 and pentaoxide means O_5

Thus N_2O_5

18.3 Writing Formulas and Naming Compounds

14. The overall charge on the polyatomic dichromate ion ($Cr_2O_7^{-2}$) is -2. What is the oxidation number of chromium in this polyatomic ion?

A) +7

B) +12

C) +6

D) +2

(162 Final, Q13)

18.3 Writing Formulas and Naming Compounds

14. The overall charge on the polyatomic dichromate ion ($Cr_2O_7^{-2}$) is -2. What is the oxidation number of chromium in this polyatomic ion?

A) +7

B) +12

C) +6

D) +2

(162 Final, Q13)

18.3 Writing Formulas and Naming Compounds

dichromate ion $Cr_2O_7^{2-}$:

Let X be oxidation number of chromium in this polyatomic ion

Total charge of entire $Cr_2O_7^{2-}$ = 2(X) + 7(-2) = -2

So X = +6

15. What is the oxidation number of sulfur in the polyatomic ion SO_4^{2-}?

A) 6 -

B) 6 +

C) 2 -

D) 8 -

(161 Final, Q6)

18.3 Writing Formulas and Naming Compounds

15. What is the oxidation number of sulfur in the polyatomic ion SO_4^{2-}?

A) 6 -

B) 6 +

C) 2 -

D) 8 -

(161 Final, Q6)

18.3 Writing Formulas and Naming Compounds

sulfate ion SO_4^{2-}:

Let X be oxidation number of sulfur in this polyatomic ion

Total charge of entire SO_4^{2-} = (X) + 4(-2) = -2

So X = +6

Mixed-type Questions

Mixed-type Questions

1. Which of the following statements is NOT correct?

A) When the flow of a fluid is restricted its speed increases and its pressure decreases.

B) The volume of a gas is inversely proportional to its temperature at constant pressure.

C) Sublimation is the process of a solid changing directly to a gas.

D) Water expands as it cools from about 4ºC to 0ºC.

E) Stars are in plasma state.

(171 Final, Q13)

Mixed-type Questions

1. Which of the following statements is NOT correct?

A) When the flow of a fluid is restricted its speed increases and its pressure decreases.

B) The volume of a gas is inversely proportional to its temperature at constant pressure.

C) Sublimation is the process of a solid changing directly to a gas.

D) Water expands as it cools from about 4ºC to 0ºC.

E) Stars are in plasma state.

(171 Final, Q13)

Mixed-type Questions

2. Which of the following statements is NOT correct?

A) The pressure of a gas is inversely proportional to the volume of its container at constant temperature.

B) When the flow of a fluid is restricted its speed decreases and its pressure increases.

C) Water expands as it cools from about 4ºC to 0ºC.

D) The Sun is in plasma state.

(161 Major 2, Q11)

Mixed-type Questions

2. Which of the following statements is NOT correct?

A) The pressure of a gas is inversely proportional to the volume of its container at constant temperature.

B) When the flow of a fluid is restricted its speed decreases and its pressure increases.

C) Water expands as it cools from about 4ºC to 0ºC.

D) The Sun is in plasma state.

(161 Major 2, Q11)

Mixed-type Questions

3. Which of the following statements is correct?

A) Amorphous solids do not have a specific melting point.

B) Heat of fusion is the amount of energy required for the liquid at its boiling point to become a gas.

C) Evaporation occurs throughout the liquid at a specific temperature.

D) Most of the ordinary matter in the universe is in gaseous state.

(152 Final, Q11)

Mixed-type Questions

3. Which of the following statements is correct?

A) Amorphous solids do not have a specific melting point.

B) Heat of fusion is the amount of energy required for the liquid at its boiling point to become a gas.

C) Evaporation occurs throughout the liquid at a specific temperature.

D) Most of the ordinary matter in the universe is in gaseous state.

(152 Final, Q11)

Mixed-type Questions

4. Which term describes silicon?

A) Metalloid.

B) Metal.

C) Nonmetal

D) Noble gas.

E) None of these.

(142 Major 2, Q16)

Mixed-type Questions

4. Which term describes silicon?

A) Metalloid.

B) Metal.

C) Nonmetal

D) Noble gas.

E) None of these.

(142 Major 2, Q16)

Mixed-type Questions

5. Which of the following statements is TRUE?

A) An object floats on water when the buoyant force is less than its weight. B) When the flow of a fluid is restricted, its velocity decreases and its pressure increases.

C) The volume of a gas is directly proportional to its pressure at constant temperature.

D) The volume of a gas is inversely proportional to the temperature at constant pressure.

E) In a hydraulic lift, the pressure on one side (smaller cylinder) is equal to the pressure on the other side (larger cylinder).

(142 Final, Q28)

Mixed-type Questions

5. Which of the following statements is TRUE?

A) An object floats on water when the buoyant force is less than its weight. B) When the flow of a fluid is restricted, its velocity decreases and its pressure increases.

C) The volume of a gas is directly proportional to its pressure at constant temperature.

D) The volume of a gas is inversely proportional to the temperature at constant pressure.

E) In a hydraulic lift, the pressure on one side (smaller cylinder) is equal to the pressure on the other side (larger cylinder).

(142 Final, Q28)

Feedback

Any comments/feedback/suggestion for improvement, or if you need to discuss anything related to these questions, please do not hesitate to contact me at:

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The End of the Beginning